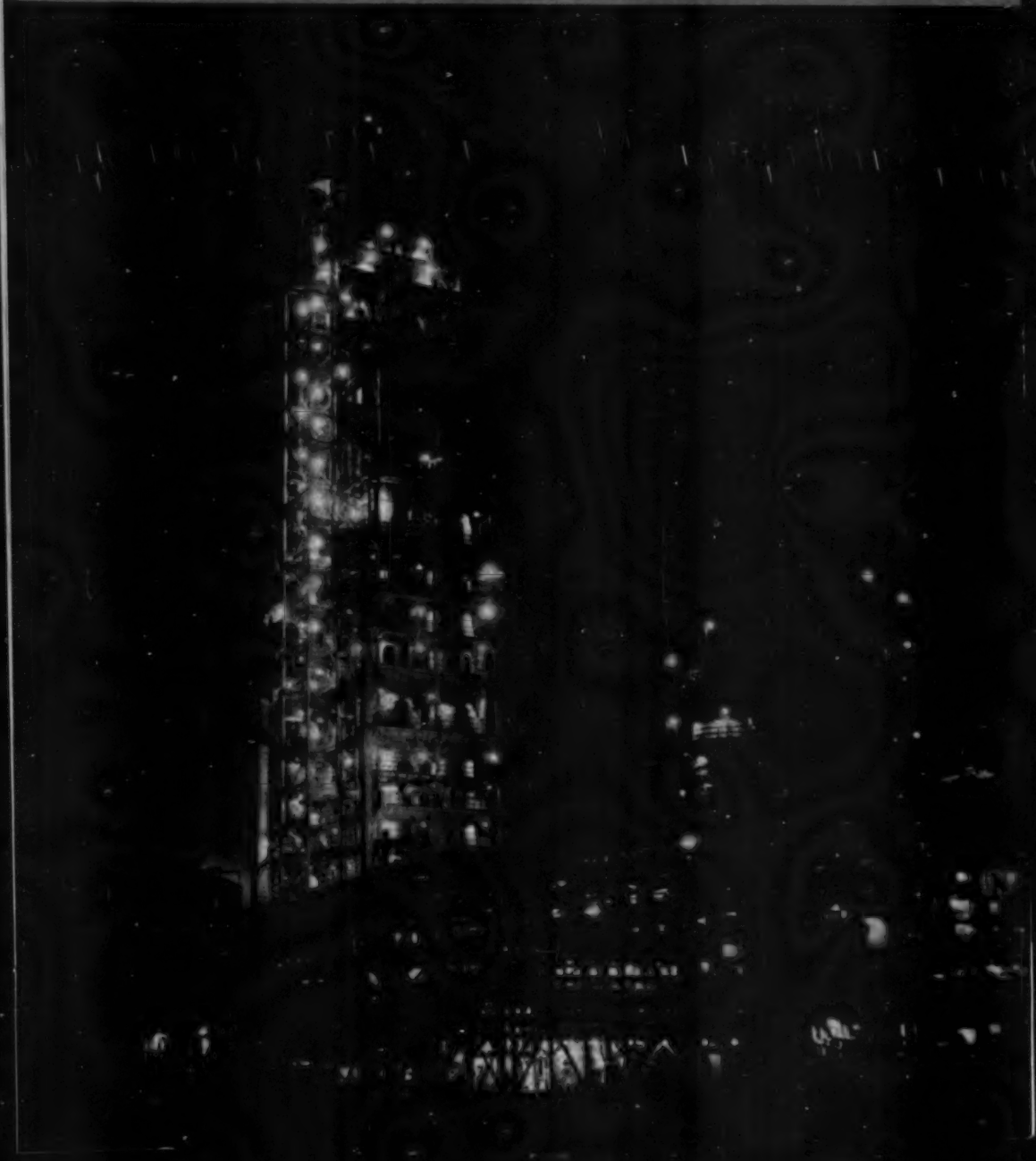
NOVEMBER 1951

INDUSTRY AND POWER

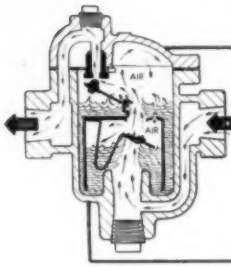
For Executives and Engineers Responsible For Engineered Plant Services



ARMSTRONG "BLAST" TRAPS SPEED UP HEATING

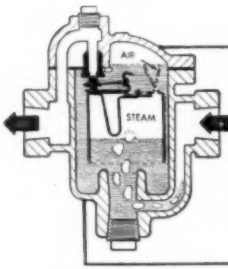
of Single Pipe Coils, On-and-Off Multiple Coils, Unit Heaters, etc.

AIR WHISTLES RIGHT THROUGH



VENT OPEN

Note large air bubbles "whistling" through large thermic-control vent to be discharged with condensate through open trap valve. Shaded grey area is condensate.



VENT CLOSED

After accumulated air and condensate are discharged, large vent closes. Small vent is always open to handle ordinary volume of air entering trap.

In equipment where large amounts of air accumulate when the steam is turned off, and where the air can be pushed out ahead of the steam, Armstrong "Blast" Traps provide remarkably fast heat-up. A corrosion resistant invar and stainless bi-metal strip holds open a very large vent which lets air whistle right through the trap when equipment or lines are cold. As soon as steam reaches the trap, the bi-metal closes the big vent.

Armstrong Blast Traps combine the benefits of quick heat-up with the dependable service of mechanical traps. There is no bellows to leak or collapse due to high pressure. In fact, the traps are hydraulically tested at 500 lbs. pressure before they leave the factory.

Call your nearby Armstrong Representative for details and prices.

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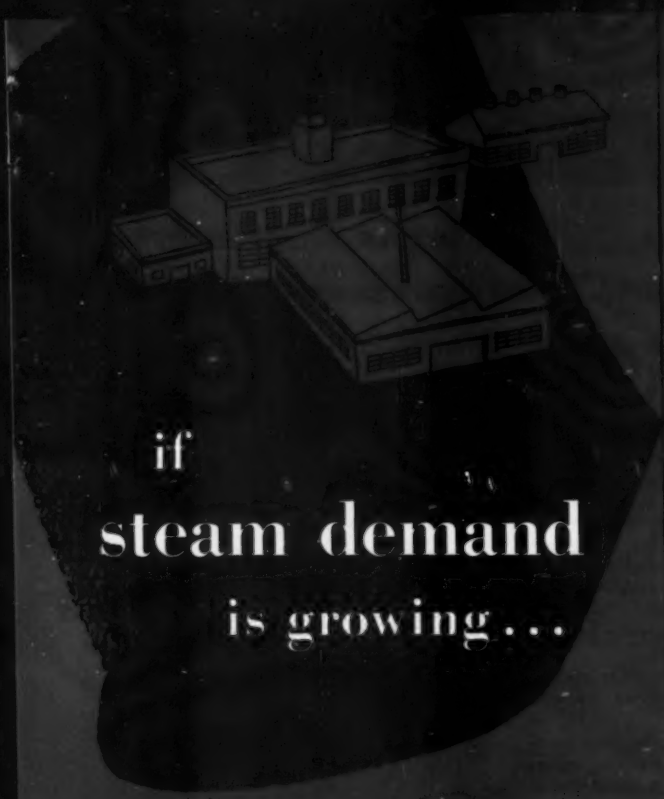
THE ARMSTRONG STEAM TRAP BOOK tells all about Armstrong Blast and Standard Traps—where to use them and how to select and install them. You are welcome to a copy. Just write for it.

SEE OUR CATALOG IN SWEET'S

ARMSTRONG STEAM TRAPS



if steam demand is growing...

and your boiler plant is not...

maybe Beacon Combustion Service can help you bridge the gap

* A service, by over well-qualified combustion engineers, dedicated to helping you get MORE from your fuel. Available at no cost or obligation to users supplied by Eastern Coal Sales Offices.

If your [illegible] plant is suffering from OUT-growing pains . . . because the business it serves has grown and the equipment has not . . . don't decide that an addition or a new plant is the only answer. Your old plant may have more capacity than you think. Our Beacon Combustion Service plan can cure a lot of main pains . . . and in many instances, through a change in practices, the addition of minor auxiliary equipment or a change in type of coal, have boosted output from 10% to 50%.

FOR EXAMPLE: In one pulverized installation, the Beacon Combustion Service plan found leakage around the dead plates, and burned out and broken tuyeres. Correcting these conditions boosted boiler performance to meet all demands for heat.

FOR EXAMPLE: Steam supplied by two underloaded boiler fill the place of needed

The B.C.S. Man diagnosed the cause . . . oxygen starvation from inadequate combustion. He recommended [illegible] —lower draw-offs, and the [illegible] outside air duct. Extra capacity [illegible] steam. In another instance, merely substituting a larger nozzle has eliminated gas dalliance.

FOR EXAMPLE: Hand fired plant with a chimney clearance ceiling which not only could not deliver required steam, B.C.S. Man suggested change to double-grate stoker. Elimination of dross permitted forced draft flow, greater combustible rate, lower cost of steam four times more economical by increased boiler performance.

Maybe the B.C.S. Man can help YOUR plant develop a new use of capacity. Why not see?

NOTE TO COAL DEALERS. If any of your commercial or industrial customers or prospects have a problem like this, your B.C.S. Man will be glad to assist with [illegible]

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EASTERN GAS AND FUEL ASSOCIATES

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For Orifice Meters, Regulators, Gage Lines, Instrument Panels, Christmas Trees, By-pass Lines, etc.

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Built in globe or angle design, screwed or socket welding ends, ¼, ⅜, ½, ¾ and 1 in. sizes. Working pressure ratings 6000 lb WOG, 1500 lb at 850 F with carbon steel bodies, and 1500 lb at 1000 F with 13 per cent chromium EV alloy stainless steel bodies. Write today for Bulletin 491.

ACTUAL VALVE SIZE ▶

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Please send me Bulletin 491—on Fig. 952B & 2952 Series

Name

Company

Street

City Zone State

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Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

Edited specifically for executives and engineers responsible for the selection, installation, operation & maintenance of equipment required for Engineered Plant Services*

INDUSTRY AND POWER

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**Engineered Plant Services*

By ***Engineered Plant Services*** we mean the ***providing*** or ***generating, transmitting, controlling, applying,*** and ***maintaining*** of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial establishment as required for production and operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

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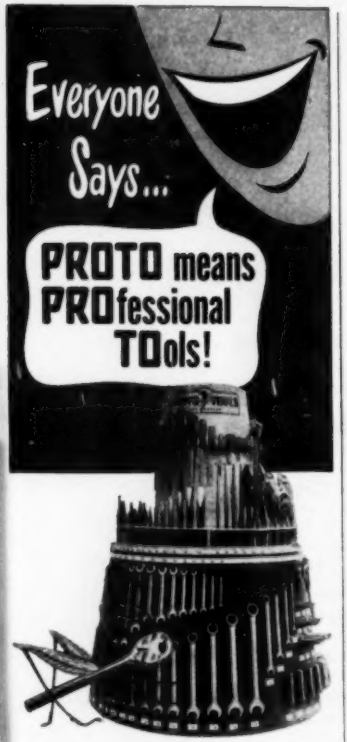

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Acorns of science

Developments not yet available, but of interest to those responsible for Engineered Plant Services

Fat Production

● Manufacturing plants may soon be competing again with nature and turning out fat synthesized by microorganisms. Submerged growth of organisms, depending on agitation and aeration methods used in production of penicillin and other materials, would be used. Scientists of Illinois Institute of Technology report that extensive reviews have been published detailing the many organisms, yields and conditions governing the formation of fat by organisms. To date, no process can compete with fats derived from plants or animals, but mutation of new organisms promise the possibility of meeting given specifications in a tailor made raw product. The process could also be used when other sources are cut off or inadequate.

Pumping Fluorine

● Patent No. 2,502,074 describes a liquid-piston type of pump adapted for automatically pumping, compressing or transferring fluorine gas. The pumping fluid is liquid hydrogen fluoride containing a dissolved fluoride salt such as potassium fluoride.

Boron as a Hardener

● With nickel, chromium and some other hardening elements on the critically short list, a United States Steel Corp. engineer reports that recent tests show boron to be a successful substitute in the majority of applications for the constructional alloy steels. The element has already been used for some applications during and since World War II. Obtained from borax, only a few thousandths of one per cent is ordinarily used, and it can replace several hundred times its own weight of other hardening materials.

Safety Armor

● Just as safety helmets evolved from military types, so new developments in armored clothing for troop protection may be a preview of future industrial clothing. A new helmet of laminated nylon worn under an aluminum shell has improved resistance to missiles. Body armor includes a cotton jacket which has front and back pockets to carry panels of laminated glass fiber and plastic capable of stopping a .45 caliber bullet. Even part of that protection would sometimes be welcome.

Interesting Process

● Continuous process, experimental oil fired hop dryer, developed by Washington State Institute of Technology receives hops between two mesh belts which take them through the drying cycle. Greater uniformity, higher quality and lower costs are predicted and may lead to similar applications on other materials dedicated to more sober uses in industrial plants.

Impact Recorders

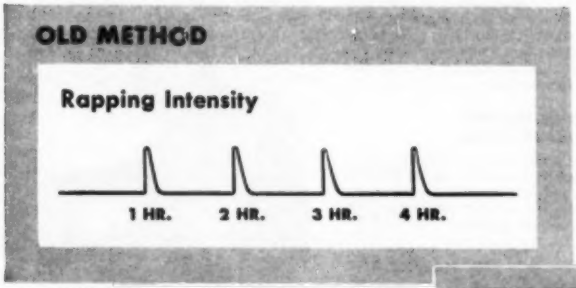
● A new instrument for measuring impact and being tested by the Air Force is so small that it can be concealed in a package to record shipping bumps. Three recording arms mark a wax coated tape for a 28 day record, can even tell when someone ignored the "This Side Up" sign.

Another instrument has a 14 channel magnetic head that will record activity at as many points in a test package for short time shocks. A magnetic tape feeds at 60 in. per sec for 6 min, and has a maximum play-back time of one hour. The record shows amplitude and frequency of shock and vibration from 2 to 500 c under accelerations on the package up to 80 G.

New Development

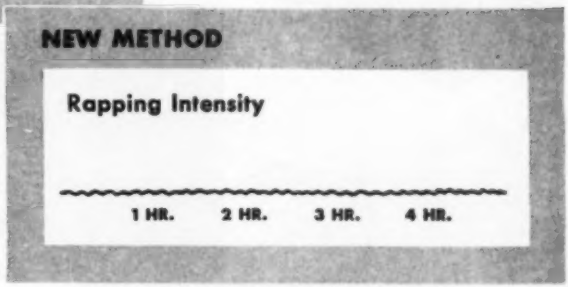
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

AD-109

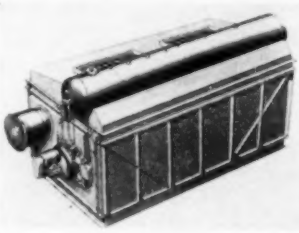
New equipment and developments

Highlights of new products by leading manufacturers

Each new product item has a key number for your convenience in asking for additional, detailed information. Insert key number on return post card on page 133

1—Packaged boilers easily installed

Two new boiler designs in the packaged boiler field have been introduced by the Wm. Bros Boiler & Mfg. Co. Named Type W, these packaged units offer a capacity range of 4100 to 11,600 lb of steam per hr in the W-1 model and 11,400 to 23,500 lb per hr in the W-2. The W-1 features a com-



plete two-pass vertical gas travel system and has a shorter furnace width for moderate capacity requirements. In the W-2, gas travel is directed by a complete two-pass horizontal system designed to deliver a larger capacity economically. Standard design pressure for both models is 160 psi. These boilers can be skidded into place and installed without any special connections. Either oil or gas fuels may be used, and switchover is simple.

2—Air conditioner offers zone control

A completely new line of central system zoning Weathermakers, designed especially to provide independent control of air conditioning in separate areas of a building through a single unit, is announced by Carrier Corp. Five sizes are being produced with air conditioning capacities ranging from 12 to 58 ton, with zone controls varying from 5 to 14 depending on size. The units will be particularly useful in office or other multi-room buildings, manufacturing plants, and other spaces where cooling or heating loads vary in different rooms or areas due to the changing position of the sun or need for different processing temperatures. The new Weathermakers are of the horizontal blow-through type. Damper control for separate zones is provided through a double outlet arrangement, with one outlet supplying cooled and dehumidified air and the other supplying warm air. These twin outlets are divided into separate dampering compartments.

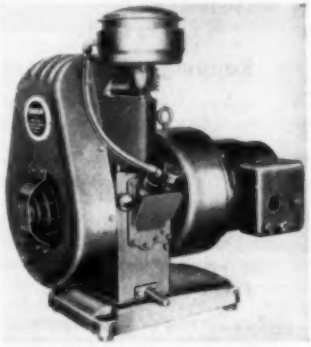
3—Grounds located without shutdown

The Allen ground detector being produced by Excel Electric Service Co. makes possible the tracing and location of a ground in an electric system without interrupting the flow of power. A signal generator superimposes

a pulsating alternating signal current on the grounded phase conductor. A hand detection unit is then used to trace this signal current through the grounded phase until the ground is located. Moving the detection unit beyond the ground stops the needle's rise and fall.

4—Electric plant uses furnace oil

A small 3000 w diesel electric plant, powered by an air-cooled full-diesel Onan engine, is announced by D. W. Onan & Sons Inc. Simplified plant design makes it possible for anyone to operate and service this Model 3DSP-1E diesel unit. Push-switch control for electric cranking, manual compression release, and an electrically heated glow-plug for cold weather starting are provided. The improved four-cycle single cylinder engine consumes approximately 0.155



gal of low-cost furnace oil per kwh at full rated load. This unit generates 115 v 60 c single-phase current. Other a-c models available in single-phase produce 230 v and 115/230 v.

5—Operational variables closely controlled

The Fielden Instrument Corp. is offering their latest ARC-1 automatic control for use in stabilization of process variables without the considerable time lapse often encountered. Particularly adapted to continuous drying,

the control provides a continuous indication and record of the process variable and automatically controls the machine to correct for any deviation from the desired control point. It may be set to ignore momentary deviations, then make corrections, which are proportional to the deviation from the control point at time intervals automatically adjusted to suit machine or process speed. Installation is simple. Push buttons on the in-

(Continued on page 10)

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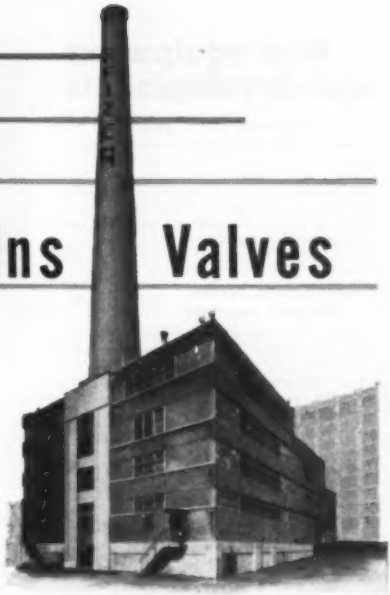
Power House and Process Piping at new 60-acre Pfizer Plant equipped for years ahead with

Jenkins Valves



General Contractors, W. J. BARNEY CORP. Piping Contractors, J. H. MERRITT CO.

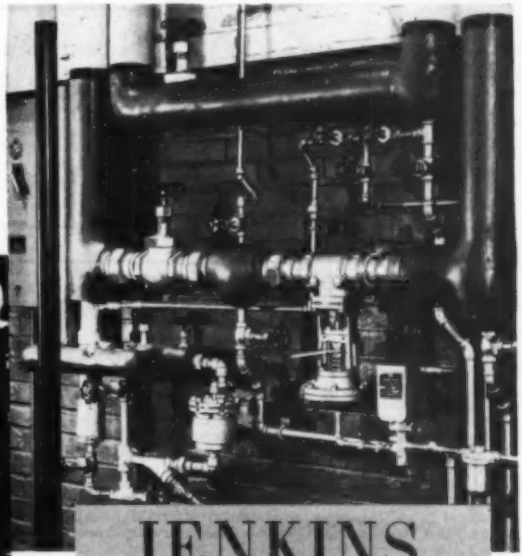
At Groton, Connecticut, the new plant of Chas. Pfizer & Co., Inc., provides additional capacity to meet mounting demands for this company's fine chemicals and antibiotics.

In Pfizer's continuous process manufacture of these products, the dependability of the heat and power supply is vital. That is why you'll find Jenkins Valves in the new power plant, and, in fact, throughout the intricate network of process pipelines.

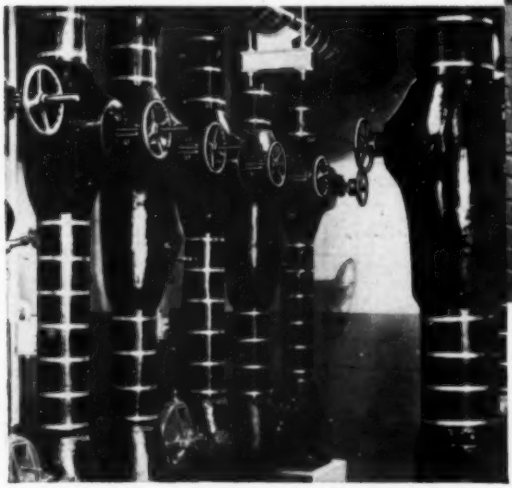
Because the power demand is endless, it requires—even in normal times—unfaltering efficiency of all component equipment. And because operating economy depends on *continued* efficiency in the years ahead, Jenkins Valves have long been the choice of the men who plan, build, operate, and maintain the nation's vital power installations.

They know that Jenkins builds *extra* endurance into valves. Yet despite this *extra* value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Avenue, New York 17. Jenkins Bros., Ltd., Montreal.

Some of the Jenkins Valves installed in the Pfizer power plant. Its rating is 230,000 lbs. per hour from two oil-fired boilers.



Large Jenkins Gate Valves on pipelines serving the 12-step Pfizer process of synthesizing a stable form of crystalline Vitamin A, the first produced on a commercial scale.



JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864

TRADE JENKINS MARK

Jenkins Bros.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

New equipment and developments

(Continued from page 8)

strument panel, and elsewhere if required, provide manual control. Pilot lights show status of process variable and also when a correction is being made.

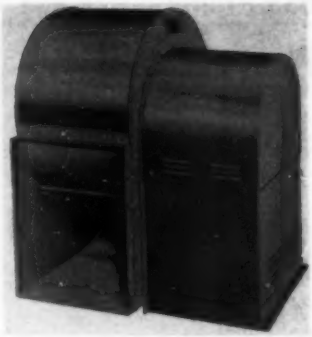
6—Electrode holder features comfort

Erico Products announces their Caddy Type A electrode holder, designed for mechanical and electrical efficiency and for operator comfort. Available in 300 and 500 amp capacities, the holder is connected to the welding cable by the Cadweld process.

Recent designed handguard and body construction result in cooler operation, and the spring assembly enclosed in the handle is engineered to give uniform pressure when inserting or ejecting electrodes. Other features are a deeply grooved jaw, extra large hinge pin and replaceable stud.

7—Fan arranged for outdoor mounting

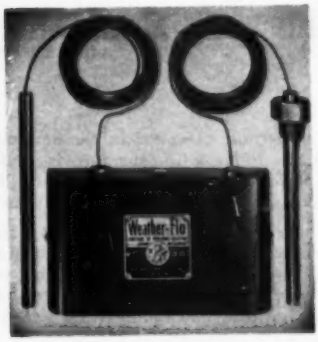
Compact centrifugal fan arrangement, with weatherproof hood over the motor drive section, has been announced by the Trane Co. This fan is available with wheel diameters as large as 60 in., in backwardly inclined and forwardly curved, single width, single inlet models in Class I construction. Designated as arrangement No. 10, the fan has high-efficiency, low noise and low hp



characteristics. The Trane line includes forward curved models in 21 sizes from 12 to 89 in. wheel diam, and backwardly inclined models in 23 sizes from 12 to 109 in. diam. Each size is made in double and single widths, in both Class I and II construction, standard motor and drive arrangements.

9—Control foresees heat requirements

The Weather-Flo "indoor-outdoor" modulating heating control, product of Automatic Devices Co., utilizes an outdoor weather reading in combination with a temperature measuring bulb in the heating system to change the rate of heat flow with every change of the weather in anticipation of the heating needs of the building. A built-in fan or pump switch provides for a continuous



regulated flow of heat to the building as long as weather conditions require heating. Heating lags caused by overshooting and underheating are eliminated, giving a constant, uniform heating level at the desired temperature from the least amount of fuel. Ease of adjustment is assured by having the four adjustment dials calibrated in actual temperature settings. Simple to install, the control is designed for operation with all fuels and heating systems and is suited to single family or multiple occupancy buildings.

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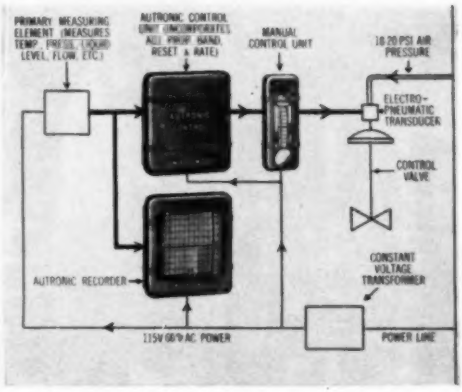
10—Additive prevents filter clogging

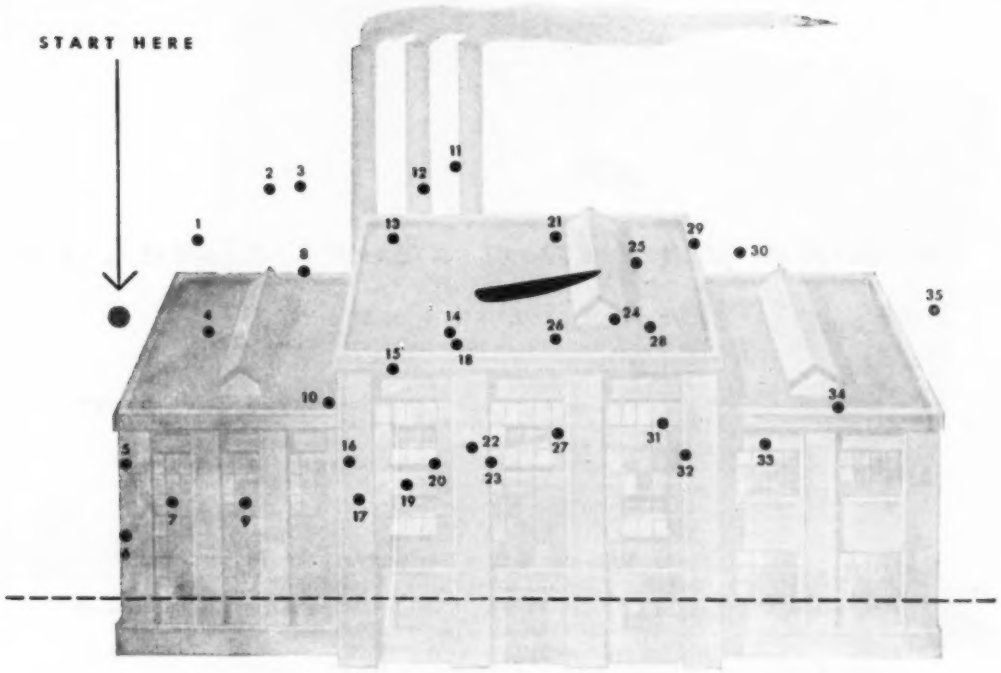
An additive for fuel oil that virtually eliminates filter screen clogging in domestic fuel oil burners is now being marketed by Shell Chemical Corp. The product, called Ionad 17, is also for diesel engine use, where it will reduce maintenance costs due to clogged screens and fouled fuel-injector parts. Field tests have proved Ionad 17 to

(Continued on page 14)

8—Miniature control has centralized features

An automatic all-electronic instrumentation and control system for use in the chemical and food processing plants, refineries, petrochemical installations, industrial power plants and central stations is announced by the Swartwout Co. Identified as the Autronic control system, it is the first centralized-control, miniature, all-electronic system for measuring and controlling process variables such as temperature, pressure, level and flow. It consists essentially of three basic units: Primary sensing element, Autronic control unit and final control element. The system is powered by 115 v, 60 c a-c. Primary sensing element generates a voltage, which is directly proportional to any change in the process variable. This voltage—always within the same range regardless of whether temperature, pressure, flow or level is being measured—is transmitted and continuously modulated by electronic means. The unit then transmits the resulting direct current to the final control element, which may be either electrically or pneumatically operated. Since transmission of information throughout the system is by electrical means, there is no transmission lag. Furthermore, there are no slide wires to initiate control action, no booster mechanisms or other equipment to overcome distance effects. This compact, plug-in type unit can be mounted at any convenient location so that all adjustments can be made at the graphic panel or central control point, without the usual transmission lags. It incorporates accurate calibrated adjustments for proportional band, reset and rate time.


PRIMARY MEASURING ELEMENT (MEASURES TEMP, PRESS, LIQUID LEVEL, FLOW, ETC.)
AUTRONIC CONTROL UNIT (INCORPORATES ALL PROP. BAND, RESET & RATE)
MANUAL CONTROL UNIT
3-15 PSI AIR PRESSURE
ELECTRO-PNEUMATIC TRANSDUCER
CONTROL VALVE
AUTRONIC RECORDER
CONSTANT VOLTAGE TRANSFORMER
115V 60~ AC POWER
POWER LINE



This puzzle may solve a plant puzzle for you!

This is The BETZ INDICATOR, a monthly publication devoted to general discussion of all water problems. It's free. Write.

Water for industrial use can . . . and usually does . . . pose an infinite variety of unidentical problems. Variables include the water itself, the plant equipment, the operating conditions and a host of other factors. The proper approach to the solution of a water treatment problem . . . however puzzling . . . is to engage specialists who provide an adequate and well-balanced program of scientific control.

BETZ is a nationwide service organization specializing in the solution of all water problems. We offer a complete water conditioning service that is scientifically correct—designed to help you maintain all-out production. If the results you are presently obtaining are not entirely satisfactory, let us explain how our specialized service can help you. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Penna. In Canada: BETZ Laboratories Limited, Montreal, 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

a long way in a short time . . .

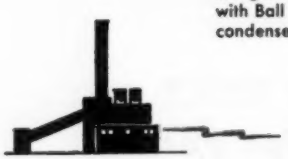
FIVE-FOLD EXPANSION IN TEN YEARS

The large up-to-the-minute steam-electric station, depicted here, again furnishes proof of management's desire to keep up with the needs of a growing economy.

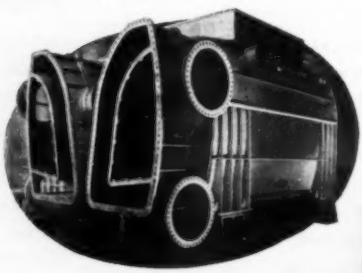
The area served by this cen -al station consists of free-enterprising people who depend on an uninterrupted and adequate source of electric power for their growing industries. The Midwest Utility which serves this community built its first 60,000 kw unit in the area in 1942 to meet the industrial needs of World War II. Today a five-fold expansion program, which will bring the station's installed capacity up to 300,000 kw, is drawing to a close.

Foster Wheeler Steam Generators, Condensers, and Auxiliary Steam Generating Equipment

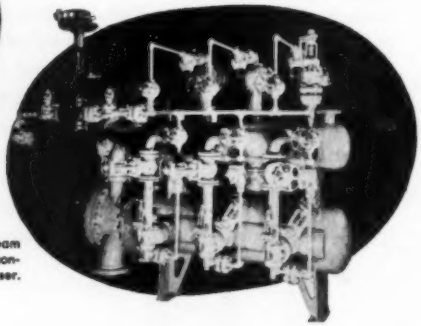
The Foster Wheeler installations which contribute so largely to the success of this great undertaking include four 640,000 lb per hr steam generators with Ball Mill Pulverizers, firing equipment, and plant equipment including condensers, steam jet air ejectors and feedwater heaters.



FROM 60,000 to 300,000 KW

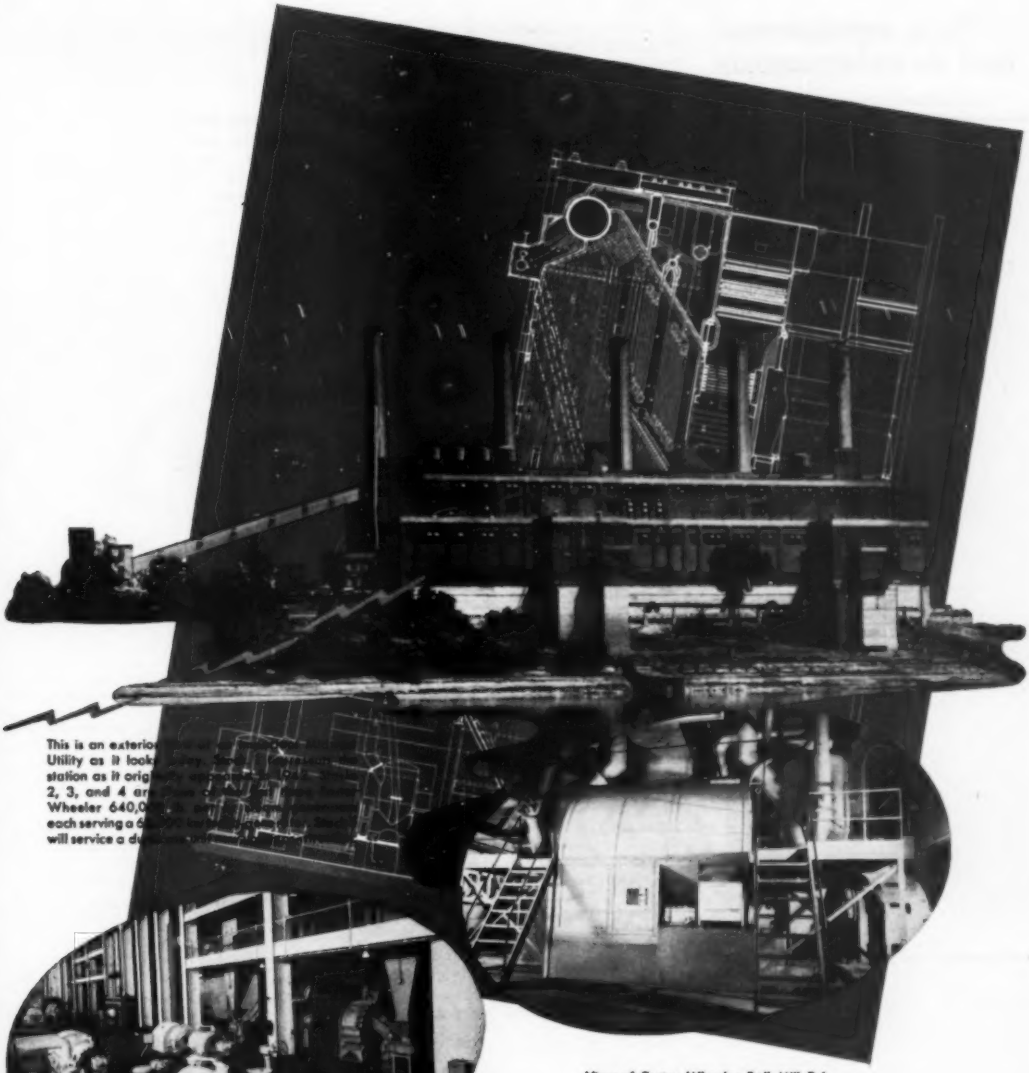


Shop photograph of one of the 55,000 sq ft Foster Wheeler surface Condensers serving the 60,000 kw turbines.



Shop view of a Foster Wheeler steam jet air ejector which removes non-condensible gases from the condenser.

FOSTER WHEELER



This is an exterio
Utility as it look
station as it orig
2, 3, and 4 ar
Wheeler 640,0
each serving a 6
will service a d

View of Foster Wheeler Ball Mill Pulverizer, one of twelve which will be in service when the station is completed.

View of operating floor with exhauster of Foster Wheeler ball mill in right background.

CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

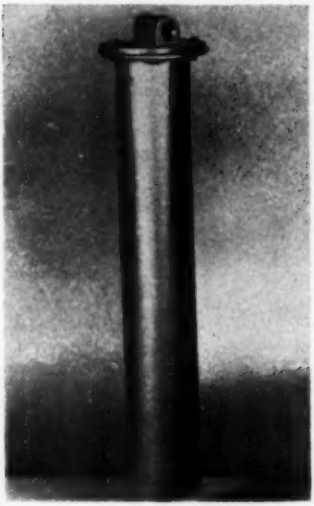
New equipment and developments

(Continued from page 10)

be stable, non-corrosive and easy to use. Along with its non-clogging feature, it reduces the severity of treatment usually required by the refiner and also prevents the accumulation of tank sludge.

11—Air filter acts as condenser

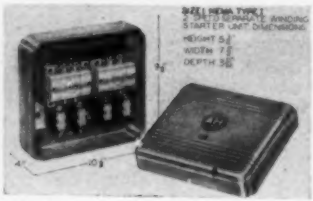
A long compressed air line filter, which functions also as a condenser is announced by Air-Line Engineering Co. Called the Airlenco condensing filter, this device has a steel outer shell 6 in. in diam by 36 in. long,



and a steel inner cartridge 5 in. in diam by 24 in. long. It is loosely packed with Fiberglas. Air enters the inlet opening and passes down between the inner and outer shells. Expansion of the air and the extensive cooling surface cause any moisture in the air to condense and fall to the bottom of the outer shell, where it is discharged through the drain valve. The air then passes through the Fiberglas in the inner cartridge, which removes remaining moisture with no appreciable loss in line pressure.

13—Magnetic starter size reduced

The Arrow-Hart & Hegeman Electric Co. has just announced two magnetic motor starters, designated Types RAR and RAS. The RAR (reversing) and RAS (multi-speed) feature the patented Arrow-Hart "Right Angle" operating mechanism. Among other advantages claimed for this advanced design are: greatly reduced size and weight with increased operating efficiency, simplified straight-through front wiring and more



complete protection of electromotive equipment. Supplied in sizes 0, 1, 2, 3 and 4, these starters are available in a variety of NEMA housings for various applications.

14—Voltage tester easy to apply

Square D Co. has just released a model of its Wigginton voltage tester, completely redesigned to make it more functional, easier to carry, easier to use and safer. The main body of the tester is a high dielectric, one piece molded case that has a slotted receptacle on each side that provides a test mount for either prod. When not in use the prods may be inserted in the bottom end of the receptacle. By mounting one prod in

either receptacle, direct probing can be made with both hands with the voltage scale clearly visible. By mounting both prods in the top of the slotted receptacles, line to ground and similar tests can be made with one hand. The prods have 4 in. fibre insulators and hardened flat insulated steel points sharpened to pierce insulation. An open face "no fog" window and colored etched scale make voltage indication easily visible even under poor light conditions.

15—Blow-out switches come in small sizes

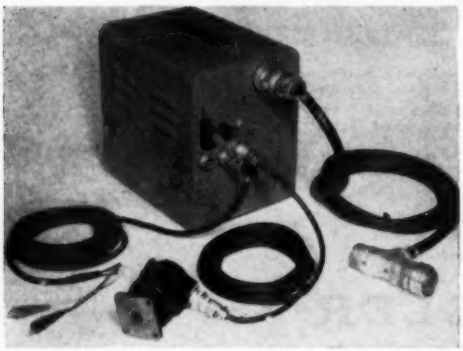
Micro Switch, a div. of Minneapolis-Honeywell Regulator Co., announces the first of a series of small size magnetic blow-out switches for use in switching high volt-

(Continued on page 19)

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly

12—Engine analyzer with portable features



Portable engine analyzer that electronically detects, locates and identifies detailed ignition and mechanical troubles in power plants containing any number of cylinders has entered production at the Sperry Gyroscope Co. A cathode-ray tube screen, on the analyzer, shows the engine mechanic the internal operating condition of the engine while it is running. It warns of cylinder and accessory failures such as bad spark plugs, sticking or damaged valves and pre-ignition before they can become serious. Principal feature is a timing adjustment, which makes setting of the timing generator on the engine unnecessary. By turning a knob shaft on the panel of the instrument, the operator can synchronize the analyzer accurately to any angle of the engine's rotating crankshaft. Other features of the instrument are: 1—Operating controls have been simplified and reduced to two knobs and three snap switches, 2—cathode-ray pattern is calibrated in degrees of engine crank angle, 3—a switch is provided on the instrument for making the screen show one or more reference makers, which are timed to a fraction of a degree to any particular position of the engine crankshaft, and 4—analyzer can operate on any power line frequency from 50 to 500 c. The unit weighs less than 27 lb, and it is 8½ in. wide, 10½ in. high and 12-3/8 in. long.

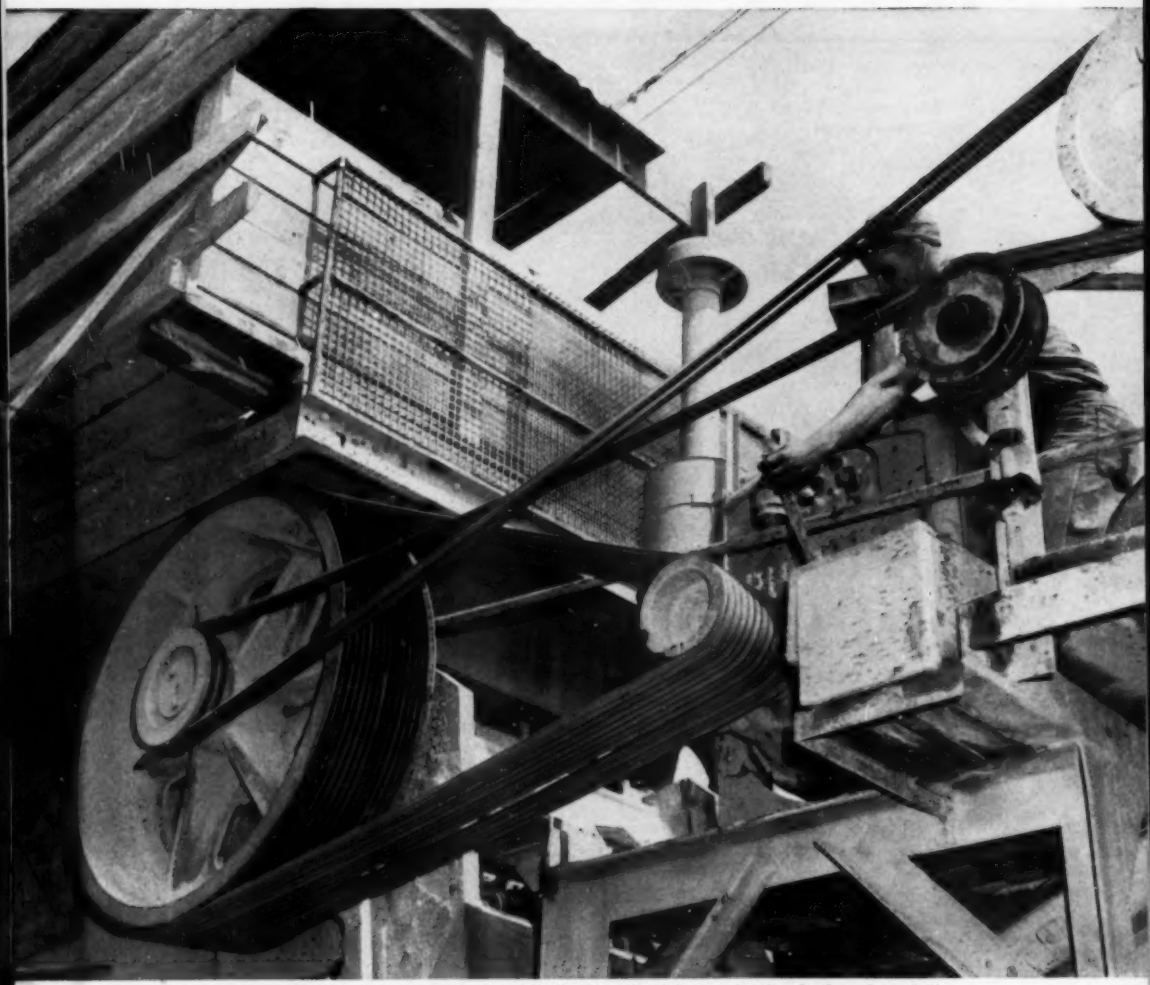
B.F.Goodrich GROMMET BELTS AT WORK

At Fry Stone and Coal Company, Hancock, Maryland—"the place where they make little ones out of big ones."

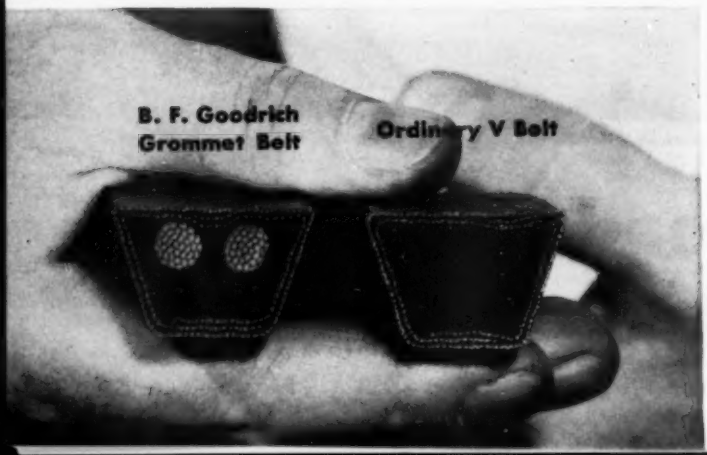
Smooth roads start here

Pounding action of this machine, used to break rocks to build roads, put terrific shock and strain on the V belts. Belts were outdoors, had to stand rain, dust, and dampness. When belts wore out, work stopped—costs went up by the minute. An entirely new kind of belt was needed. To find out how this problem was solved, see the following pages.

Smooth roads (continued)



Rubber muscles for the iron jaws that chew up hillsides of rock—"dust and rain, shock and strain."



To solve the problem described on the preceding page, a B. F. Goodrich man suggested replacing the short-lived belts with B. F. Goodrich grommet V belts. These belts look the same but, because they are made in an entirely different way, grommet V belts stand more shocks and heavier loads than any other kind. The B. F. Goodrich belts had been in use three years when these pictures were taken and looked good for a lot more use. They run 10 hours a day, 6 days a week.

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V belt. Belts last 20 to 50% longer, de-

pending on service. (The more severe the service the greater the increase over ordinary belts.)

What is a Grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet V belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

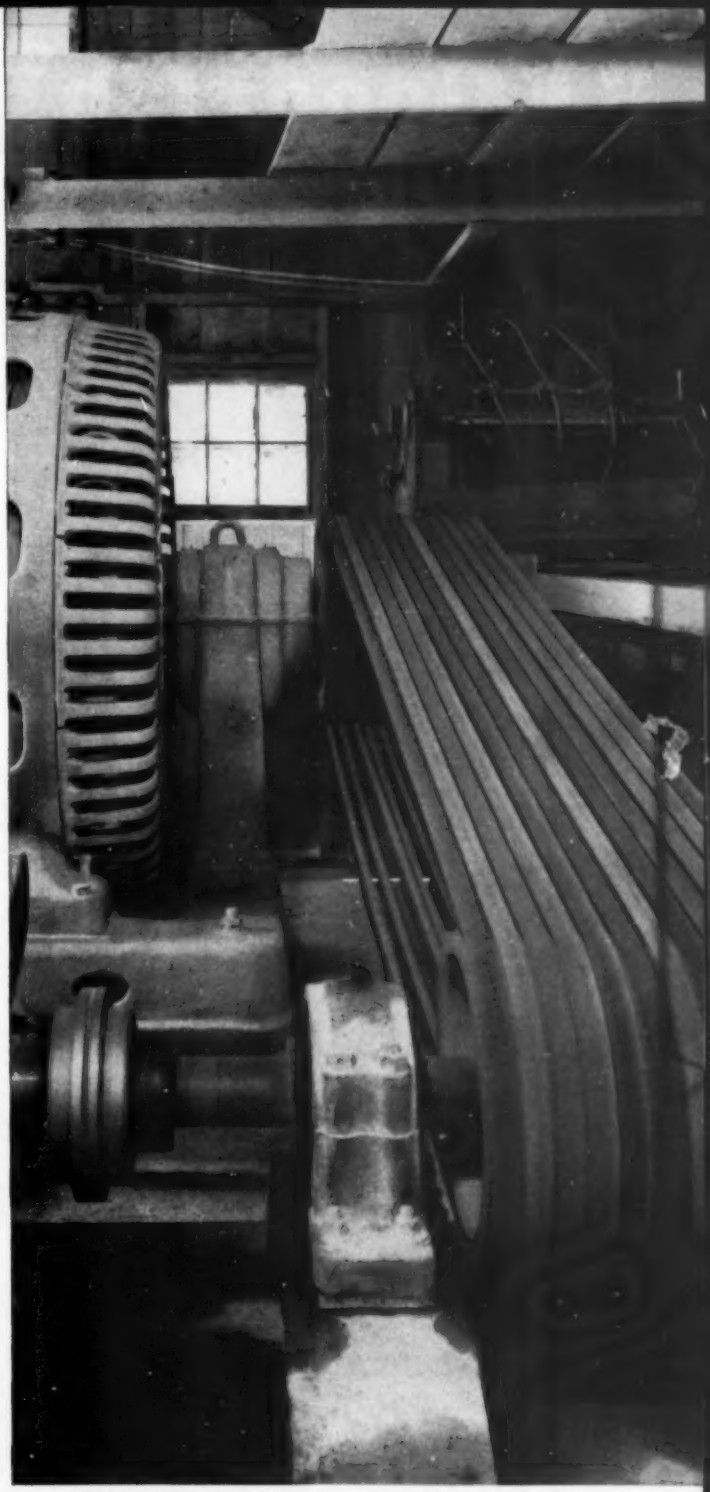
They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U.S. Patent Number 2,233,294).

Costs were cut 40% ➤➤

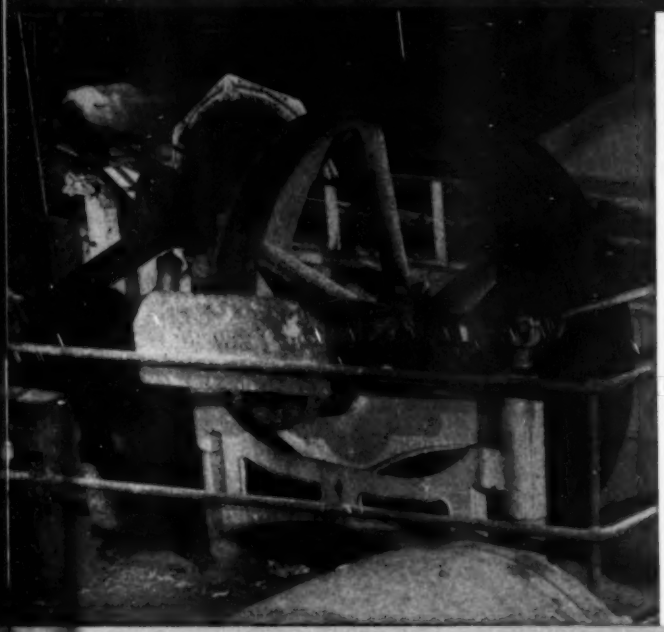
This is where they make power to run the machinery used to turn a whole stone mountain into pieces used in buildings—so much power, in fact, that the belts driving the generator have to travel a mile a minute. At that speed engineers questioned whether V belts could do the job.

B. F. Goodrich engineers studied the problem, said that grommet V belts could handle it. When this picture was taken B. F. Goodrich grommet V belts had been in service three years—looked good for much more. The owner says they cut costs more than 40%.



Rubber runs a mile a minute to cut a mountain into chunks.

B.F.Goodrich GROMMET BELTS AT WORK



Headache cured

The washer shown in the picture is used in making paper—runs 24 hours a day, 7 days a week. Belts previously used couldn't handle the job. Motor bearings were burning out, belts were snapping under the heavy, jerking load. It was the biggest drive headache at the plant of the Harding-Jones Paper Co., South Excello, Ohio.

Then a B. F. Goodrich distributor suggested grommet V belts to stand the jerks and hard pulls. Installed eight months ago, this set of B. F. Goodrich grommet V belts is going strong, looks good for many more months of use.

Bearings burned out, belts snapped until the drive was changed to B. F. Goodrich grommet V belts.

These typical examples tell you why B. F. Goodrich grommet belts are superior to ordinary V belts. They prove that grommet belts last 20 to 50% longer than other types—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

New equipment and developments

(Continued from page 14)

age d-c circuits. These snap-action switches open a new field of use in d-c circuits in industrial equipment, on railway equipment, street cars and other d-c applications. Micro magnetic blow-out switches are of the same dimensions as the Micro precision switches

built for a-c switching. The plastic case containing the switching unit measures 1-15/16 in. long, 11/16 in. wide and 27/32 in high, and weighs less than 1 oz. The new MT series switches are s.p.d.t. and come in three actuator styles — pin plunger, leaf and roller leaf.

16—Constant support hangers improved

A new constant-support hanger, Model L, providing simplified field adjustment, increased travel range and greater load capacity with a smaller number of springs and fewer chassis sizes, is now available from Grinnell Co. The function of a constant-support hanger, to provide equal lift in all position of travel of a piping system as it moves from expansion or contraction between its hot and cold positions, is performed more perfectly with the new model. A hanger structure designed for center support, nonresonance in its springing system and provision to give less horizontal shift of the load line as the load shifts from cold to hot positions are three new refinements. Maximum travel with constant support has been increased from its former 4 in. to 5 in. in the medium chassis and from 8 in. to 10 in. in the large chassis. Three chassis sizes are included, and the total load range is now covered by only 16 sizes.

17—Calculator computes steam costs quickly

A new slide rule type calculator designed to provide a ready means of computing steam costs has been made available by the Cleaver-Brooks Co., manufacturer of steam boilers and other equipment for the generation and utilization of heat. The calculator, in handy pocket size, is available without cost to engineers, plant executives, and those who will find it useful in their work. It enables the user to compute the comparative steam costs per 1000 lb using coal, oil or gas, based on fuel costs, and takes into account the efficiency of the system. On the reverse side is an easy-to-use slide indicating Cleaver-Brooks bhp, lb of steam per hr, output in Btu, EDR steam in sq ft (gross and net), oil and gas consumption per hr.

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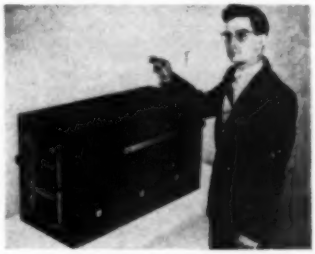
18—Power units have selenium rectifier

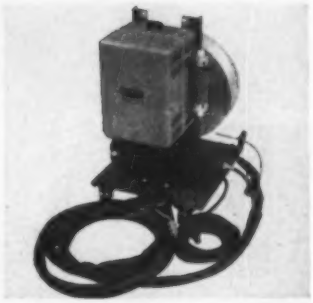
Syntron Co., manufacturers of selenium rectifiers, vibratory material handling equipment, portable power tools and other devices, announces the availability of new, custom-made a-c to d-c rectifier power conversion units of high current and voltage



capacities, 50 kw and larger. This new development is made possible by the manufacture of extra large selenium rectifier cells by Syntron's new vacuum process. The use of these larger cells permits the use of fewer parallel elements for a given d-c output and keeps the weight to the minimum.

19—Attachment feeds filler metal

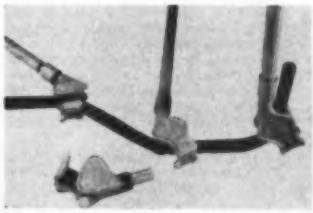
Fillerweld, a new product designed to speed alloy-metal welding on applications where filler-metal must be added, has been announced by General Electric's Welding Dept. Used with gas-shielded arc welders, the new welding attachment allows the operator to start or stop the flow of filler



metal by means of a finger switch mounted on the torch without breaking the arc, resulting in a smoother, faster weld. Fillerweld consists of two main elements—the torch or gun and a mechanical power unit. The gun is basically a manual water-cooled inert-arc tungsten holder to which has been added a control switch and a gear assembly for pulling the filler-metal from the spool to the arc through the gun. The mechanical power unit consists of a motor, which provides the power for drawing the filler-metal, a Thy-mo-trol unit for controlling the motor, and a spool, which holds the filler wire. The unit is mounted on a portable platform and can be moved easily from job to job.

20—Bending tool works in six directions

Tal Bender, Inc. has developed a new bending tool, which can be used in six different directions. The "Six-Way Hickey" with its six no-slip bending jaws is said to be an ideal electrician's tool for making bends, elbows, sets, offsets, loops, saddles and stubs on open or slab work and in close

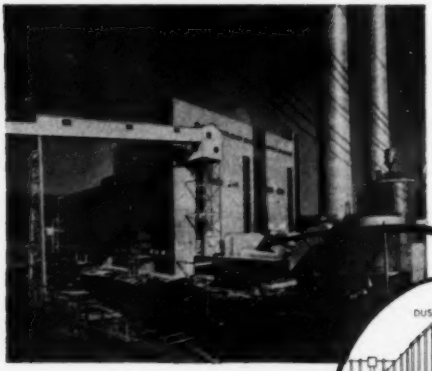


quarters. The stub hole is a new feature devised for bending or straightening conduit protruding from floors or walls. The long safety neck extends into the pipe handle for accident prevention. The sure grip jaws are another safety feature.

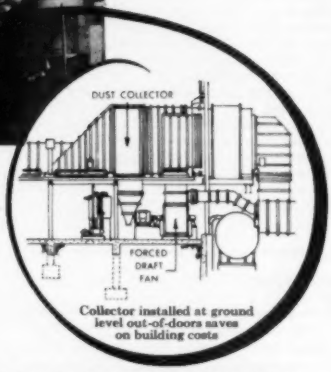
21—Pipe coupling reduces turbulence

A new style compression pipe coupling, which practically eliminates turbulence at the joint is being manufactured by the Morris Coupling and Clamp Co. It is claimed that testing and service in the field have proved the coupling's ability to materially reduce electrolytic corrosion and turbulence at pipe joints. The coupling is made up of three parts: (1) a gasket made of the material best suited for the specific job application; (2) a steel inner sleeve with precision die-cut teeth placed eccentric to the gasket teeth

(Continued on page 20)



Titus Station
Metropolitan Edison Co,
Reading, Pa.



Collector installed at ground level out-of-doors saves on building costs

Answer *your* specific dust control problems with an

AEROTEC

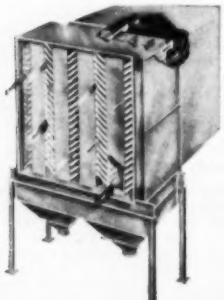
DUST COLLECTOR
exactly tailored to your needs

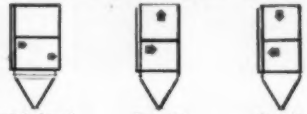
Here is one of the many instances in which the Aerotec Design 3 RAS Dust Collector proved its high efficiency so conclusively that Metropolitan Edison purchased a third unit. Gilbert Associates Inc., of Reading, Pa., were designers and constructors. Three bituminous coal-fired steam generators at this modern power plant, will be equipped with Aerotec Collectors. Layout and breeching are so designed that an Aerotec electrical secondary can be added at a future date without loss of the initial investment.

This mechanical collector, with its multiple, small-diameter tubes, offers you the advantages of high dust recovery in the ultra-fine ranges, even at partial load. The tubes are permanent mold aluminum castings of absolute uniformity. This construction provides the smooth inner wall necessary to ultra-fine dust collection. Tubes are assembled at the factory in lightweight "building block" sections. These assemblies permit flexible arrangement to suit your needs, with the economy of standard construction.

Let our engineers bring to your problems the benefits of their long experience in the field of flyash collection. No obligation.

Typical Inlet and Outlet Variations





Catalog 601 gives you complete details on standard and special Aerotec arrangements, plus other useful data on dust collection. Call or write for your copy today.

Project Engineers

THE THERMIX CORPORATION
GREENWICH, CONN.
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Canadian Affiliates: T. C. CHOWN, LTD.
Montreal 25, Quebec — Toronto 3, Ontario

THE AEROTEC CORPORATION
GREENWICH, CONN.

New equipment and developments

(Continued from page 19)

to form a complete seal; (3) a steel outer shell made of zinc coated steel or corrosion resistant metals when required, with zinc coated washers, bolts and nuts. It is made in sizes from ½ in. to 14 in. standard pipe sizes, including intermediate tube sizes. It will couple ferrous to ferrous or ferrous to non-ferrous materials.

22—Leaks stopped in concrete walls

Flexrock Co. announces addition to their Flextite of a stabilizing ingredient to speed action in sealing leaks and water seepage in concrete walls. A liquid chemical to be mixed with cement or cement and sand, Flextite produces a mortar, which when forced into

an opening, even against hydrostatic pressure, is said to seal off severe, fast-flowing leaks in a matter of minutes. This material is also recommended for plaster-coating walls above or below ground or water level, and for pointing up spalled areas. Wet or damp basements can be converted to dry, useful space.

23—Molded capacitor comes in two types

Dumont Electric Corp. announces the development of a perfectly centered, completely molded capacitor, which is said to be superior in appearance to the bakelized case capacitor. Manufactured by an exclusive process, this capacitor is always concentric,

with the section in the exact center from one end to the other, thus providing greater dielectric strength. Additional advantages claimed include: superior over-all insulation; very high humidity resistance; no wax to melt and run off; easier to work with. It is available in all sizes and two types: (1) Standard type PM with paper dielectric and mineral oil impregnant is recommended for temperatures up to 85 C. (2) High temperature type TM with new thermofilm dielectric gives highest satisfaction to 150 C.

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered—beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly

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24—*Precipitator removes oil mist*

Problems caused by the fine oil mist emanating from high speed cutting and grinding machine operations can now be eliminated by a new oil mist precipitator developed by Trion, Inc. It is based upon the electrostatic precipitation principle of attraction. Oil mist is charged as it passes through an electrostatic field and is then attracted to

plates of opposite polarity from which it eventually drains into a collecting pan for reuse. Among advantages claimed are elimination of fire hazard resulting from coating of machinery and walls by oil mist, improvement of working conditions through lessening of air pollution, and elimination of exhaust hoods on equipment. The unit is adaptable to either floor mounting or ceiling suspension.

25—*Seal prevents thread leaks*

To seal off tremendous pressures which may leak around the threads in oil well tubing, a small dam type seal made of Hycar oil resistant rubber has been devised by the Bert L. Stone Engineering Co. Called the Stoneseal, the new dam type seal is approximately the size of an eraser on a common lead pencil. In installation a hole is drilled

(Continued on page 124)

DUO-STEP Leverage

Here's how DUO-STEP doubles drainage capacity

It's startling news when a steam trap manufacturer suggests that you're using *too many* steam traps.

But if it takes *two* ordinary traps to do a job that can be done with *one* Clark Duo-Step, it's obviously a waste of money.

Clark Duo-Step Leverage actually gives *double the drainage capacity* of old-fashioned traps. This saves you money three ways: (1) in original trap cost, (2) installation and (3) maintenance.

Ask your Clark representative for an eye-opener demonstration of Duo-Step on your own steam lines . . . or write us for additional information.

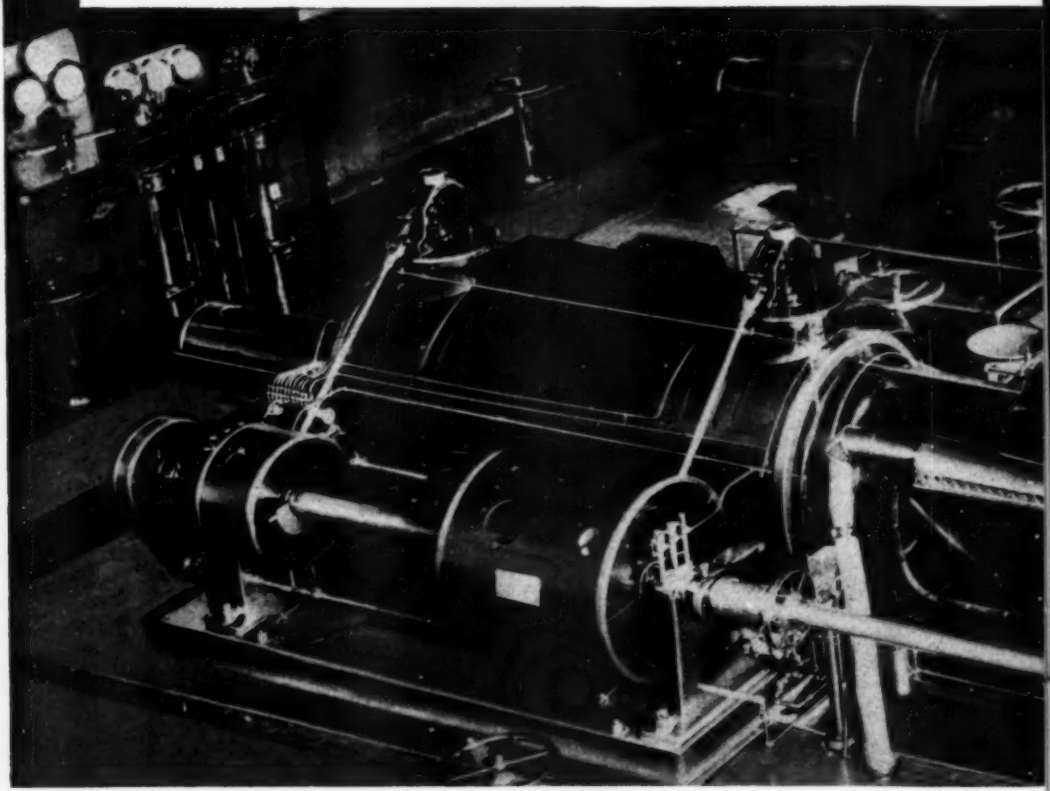
THE CLARK MANUFACTURING COMPANY
1854 East 38th St. • Cleveland 14, Ohio

Clark
THE HOME OF DUO STEP LEVERAGE

The complete line of dependable fluid controls

For Extra Fine Lubrication..

use Sinclair Rubilene



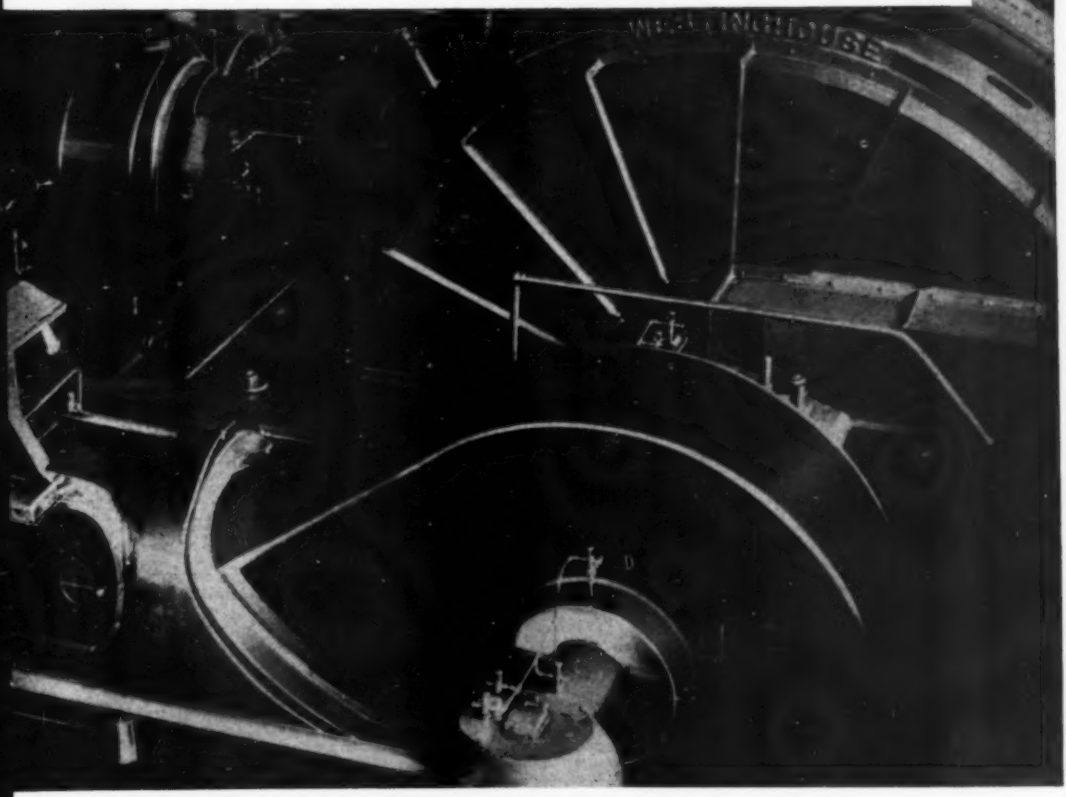
Over many years engineers and plant operators have recognized Sinclair RUBILENE® as capable of rendering extra fine lubrication performance in the powerhouse.

Sinclair RUBILENE has always been a top-quality oil, as it has been constantly improved through the years, incorporating the latest technological developments in refining and processing. It resists oxidation under continuous high temperatures, and re-circulation. It separates rapidly from water, and is non-foaming. Through long periods of use it retains its original qualities, providing uniform, trouble-free lubrication and low maintenance costs.

Yes... RUBILENE's finer quality pays dividends. For lubrication counsel, see your nearest Sinclair Representative or write direct to Sinclair Refining Co., 600 Fifth Ave., N.Y. 20, N.Y.

SINCLAIR RUBILENE®

for low maintenance costs



New bulletins and catalogs

Literature on engineering products and developments

Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 133

ANTI-CORROSIVE & PROTECTIVE COATINGS

Specialty Coatings **200**

Four page technical folder contains quick reference index to determine most suitable coatings for rust prevention, chemical corrosion, and dampness. The Wilbur & Williams Co.

Rusted Metal Primer **201**

"Worried About Rust" is a 4-page folder that tells how metal primer applied directly over rusted surfaces, stops rust and primes metal for paint. Advantages, prices, containers and other information are covered. Rusticide Products Co.

BATTERIES & CHARGERS

Battery Charger **202**

Four-circuit, motor generator battery charger is covered in 4-page bulletin 11-220. Features and advantages of the fully automatic, self contained unit are illustrated and discussed. Simple operating instructions are contained as are selection table and dimensions. The Electric Products Co.

Battery Maintenance **203**

Data sheets show how to return to full service motive power storage batteries which have lost capacity due to "sulphation". Sulphation is the formation of lead sulphate on the positive and negative plates. The 2-page sheets give 6 causes of sulphation and detail 11 steps to follow to restore batteries having various degrees of sulphation. Gould-National Batteries, Inc.

BOILERS & BOILER ACCESSORIES

Furnace Draft Control **204**

Automatic sequence furnace draft controller for on and off type firing equipment is illustrated and described in 8-page bulletin 51-489. Detailed discussions cover types for oil and gas burners, and stokers. On-the-job photographs illustrate case histories showing savings accomplished. The Hays Corp.

Condensate Meter **205**

Bulletin R-513 explains design, construction, installation and operation of rotary condensate meter, said to be an economical means of determining steam consumption where all the condensate can be captured. The 4-page bulletin includes size, dimension and weight tables, and simplified piping diagrams for both gravity and vacuum systems. Illustrated with photos of typical installations, cutaway drawings of rotor operation and sketches of features. American District Steam Co., Inc.

Combustion Control **206**

Eight-page case history (bulletin R6) tells of boiler room modernization and expansion. New equipment added, building changes, uses for steam and boiler conditions are described and illustrated. In addition text, photographs and schematic diagrams trace operation of the combustion control system. Results obtained with new equipment are listed. The Hays Corp.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

Freon Cooler **207**

Complete information on dry expansion type Freon cooler designed for use with water and other fluids for cooling applications, is contained in 10-page bulletin 101. Tables, charts and data sheets cover selection, surface required per ton of refrigeration, direct reading log mean temperature difference, dimensions and engineering data, typical piping and control arrangements. Patterson-Kelley Co., Inc.

HOW TO REQUEST FREE BULLETINS

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BUILDING MATERIALS & MAINTENANCE

Protective Lighting **208**

Complete plans for outdoor industrial lighting are provided in 24-page booklet B4791. Application suggestions and techniques are given; and various power distribution and control systems and mounting methods are provided. Westinghouse Electric Corp.

Steel Grating **209**

Booklet AIA14P21 is profusely illustrated with installation photographs showing the varied possibilities for using steel grating. The 16-page bulletin explains types and features of open steel flooring and proper installation. Specifications included. Open Steel Flooring Institute, Inc.

COMPRESSORS

Compressors **210**

Advantages of the rotary principle in producing compressed air are set forth in 4-page bulletin C6. Also explains operating features which are said to cut down maintenance time. Cross section drawings and typical installation photographs illustrate the booklet. Fuller Co.

CONTROLS, REGULATORS & INSTRUMENTS

Controllers **211**

Complete line of instruments and controllers for both boiler rooms and industrial processes is covered briefly in 12-page condensed catalog 687. Refers to detailed catalogs for specific items. Contains photographs illustrating the equipment and schematic drawing showing how the units are applied. The Hays Corp.

Control System **212**

Catalog S196C is profusely illustrated with photographs, flow diagrams, dimensional drawings, performance charts and specification tables. The 12-page booklet describes control valves, pressure master controls, desuperheaters, temperature master controls, water regulating valves, liquid level and drainage controls, differential pressure controls, feedwater heaters, feedwater regulators, separators, exhaust heads, air separators, and other accessories. The Swartwout Co.

Spring Testers **213**

New line of spring testers for both tension and compression springs are pictured and described in bulletin. Testers have capacities ranging from 200 grams to 10,000 lb. John Chatillon & Sons.

Automatic Controls **214**

Line of automatic pressure, temperature, level and flow controls is presented in 100-page catalog 53G (revised). Full information on each type of instrument is provided along with a great deal of data in tabular form on ranges, capacities, specifications, etc. Photographs and dimension drawings included. General Controls Co.

Liquid Level Gages **215**

Remote reading liquid level gages are featured in 8-page bulletin 176. Advantages and applications are listed. Tells how the unit operates and shows illustrations of three standard models covering pressures up to 1500 psi. Lists

(Continued on page 28)

Air Casualties

It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.

The kind of air a man works in has a lot to do with how much work he can turn out.

In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

A Coppus Blower or Exhauster helps avoid sickness and lassitude due to bad air . . . and improves morale, too.

Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

COPPUS

BLUE RIBBON BLOWERS

THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 191 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuslages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets, etc., after treated with coating material.

NAME .....

COMPANY .....

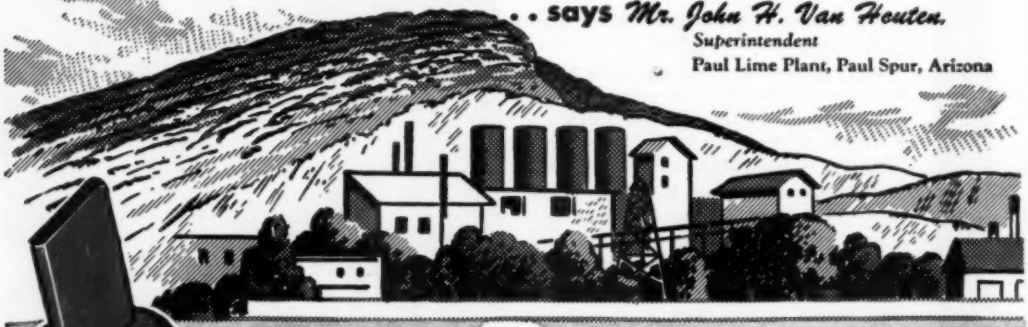
ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

"The cost of changing to FUSETRON dual-element FUSES has been paid for more than ten times over in sustained production time"

. . . says *Mr. John H. Van Houten,*
Superintendent
Paul Lime Plant, Paul Spur, Arizona



HERE'S HOW

"Prior to February, 1948 we used ordinary renewable fuses throughout our plant. They gave us short-circuit protection but we lost a great many motors due to single phasing, excessive heating and climatic conditions.

"When a motor goes out in a plant like ours, it costs us a loss in production that is difficult to make up.

"In February, 1948 we changed the whole plant over to Fusetron fuses. On the motors we installed a size to give motor running protection.

"We have completely eliminated motor losses due to single phasing and believe we have better all-around protection than before.

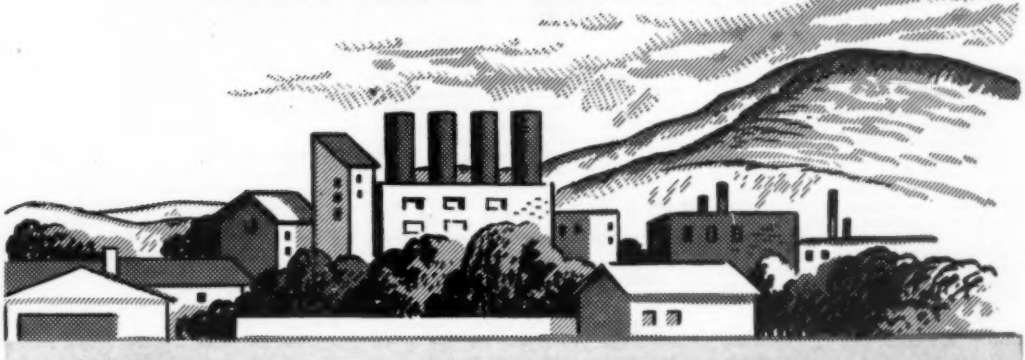
"Our records show that the cost of changing to Fusetron fuses has been paid for more than ten times over in sustained production time.

"What more could we ask?"

John H. Van Houten

(Fusetron is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

You Too, Can Cut Production Losses and Save Many Times Their Cost by Changing to FUSETRON dual-element FUSES



HERE'S WHY

FUSETRON dual-element FUSES GIVE 10 POINT PROTECTION

1. ★Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

★Fusetron fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

DON'T RISK LOSSES!

One **lost** motor . . .
One **needless** shutdown . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

USE THE COUPON

Bussmann Mfg. Co.,
University at Jefferson,
St. Louis 7, Mo.
(Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name .....
Company .....
Address .....
City & Zone ..... State .....

1151

New bulletins and catalogs

(Continued from page 24)

auxiliary equipment such as visible and audible alarms. Diagrams show typical installation and mounting. Engineering specifications included. Jerguson Gage & Valve Co.

Flow Signal Transmitter **216**

Bulletin 2551, 8 pages, describes pneumatically operated pressure-differential measuring unit that transmits proportional signals to remote recording or indicating instruments, or to automatic control elements. The signals may be linear with flow or linear with pressure differential, according to the booklet. Diagrams illustrate seven suggested uses in measurement of flow, liquid fuel, liquid level, and absolute pressure. Lists various applications. Cutaway drawing illustrates principles of operation. Hagan Corp.

Control System **217**

Photographs, line sketches, dimensional drawings and schematic diagram showing principle of operation highlight 4-page bulletin A-701 that describes the Autronic System as a miniature all-electronic system for controlling pressure, temperature, flow and level. Typical applications include chemical processing plants, refineries, central stations. The Swartwout Co.

General Catalog **218**

Proportioning equipment, instruments and feeders are presented in general catalog that lists 72 available bulletins. Covers complete line of standardized machines for automatic treating, feeding, diluting, blending, proportioning and sampling. Offers wide variety of instruments for metering and controlling flow, liquid level, temperature pressure, and weight. Also gives bulletin numbers on volumetric and gravimetric feeders for dry materials and the feeding of liquids by gravity. B-I-F Industries.

Controls **219**

Illustrations and descriptive material on special fabrication services, immersed coil and direct fired heaters, bolted and welded steel tanks, walkways and stairways are contained in 20-page catalog. Section on control equipment includes diaphragm control valves, displacement type liquid level controllers, pressure controllers, drainers, self-operated and relay regulators, safety-heads, and pressure-vacuum vent valves with flame arrestor units. Black, Sivalls & Bryson, Inc.

Tensiometer **220**

Bulletin GEA5512 describes the tensiometer, a device for continuous tension indication of cold-rolled strip. Illustrated with photographs and diagrams, the 8-page bulletin describes the mechanical and electrical operation of the unit, its possible applications, and recommended auxiliary equipment. General Electric Co.

Differential Converter **221**

Mercury-less flow meter, said to feature fast speed of response for flow control and continuous range change. adjustment from 0-20 to 0-200 in. of water, is described in 16-page catalog 2281. Operating principles of pneumatic-balance type flow transmitter are covered, as well as construction features, typical applications and detailed specifications, together with installation methods. Industrial Div., Minneapolis-Honeywell Regulator Co.

Regulators **222**

Bulletin 751 illustrates and describes pressure regulators, temperature regulators and combination pressure and temperature regulators. It includes dimensions, application, capacity, engineering tables and specification. O. C. Keckley Co.

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pH Control **223**

Automatic pH control is valuable in power plant operation, water conditioning, waste disposal, and industrial processing, says extensively revised, 40-page catalog 15-16 covering pH (hydrogen ion concentration) oxidation-reduction potential, and electrolytic conductivity. Contains new information on latest designs of pH electrodes and conductivity cells. Included are fundamental operating principles, descriptions of measuring systems, and details of components, as well as numerous typical applications. Minneapolis - Honeywell Regulator Co., Brown Instruments Div.

DIESELS

Engines **224**

Design, operation and engineering data on 4-cycle engine built for diesel, dual fuel and spark-fired gas operation, are presented in 12-page bulletin 191. Contains actual comparative test data showing advantages of the unit, principal of which are increased horsepower and thermal efficiency which is said to result in more horsepower hours per gallon of fuel and lubricating oil. Diagrams show the more common types of cooling systems applicable to the engine and presents a nomogram for determining the bmep rating under typical operating conditions. Available in sizes from 425 to 3200 bhp. Installation photographs portray some applications. Nordberg Mfg. Co.

Cushioning Material **225**

Simplified method for selection of right grade and weight of vibration mounting felt is described in 16-page booklet entitled "How to Reduce Vibration". American Felt Co.

ELECTRICAL DISTRIBUTION

Mechanical Rectifiers **226**

Mechanical rectifiers for conversion between 50 and 400 v d-c are thoroughly covered in 32-page bulletin 5106. Full information is given as to just what these units are made for and can do best. Discusses advantages of design, construction and operation along with basic principles. Diagrams, drawings, charts and photos illustrate some arrangements of the units. I-T-E Circuit Breaker Co.

Selenium Rectifiers **227**

Advantages of metallic, dry cell, selenium rectifiers are listed in 4-page bulletin. Supplies a long list of suggested industrial applications for the individual cells in a variety of sizes or as complete stacks. Shows various circuit arrangements and gives cell sizes and ratings. Syntron Co.

Frequency Converters **228**

Induction frequency converters are the subject of 4-page bulletin GEA-5637. Covers three-phase equipment in ratings from ¾ to 100 kw. Describes fundamentals, operation, and construction features of the high-frequency power supply apparatus, and includes application information, modifications, and limitations, and complete tables of ratings and frame sizes. General Electric Co.

Metallic Rectifier **229**

Metallic rectifier power-conversion units are covered in 8-page bulletin GEA5658. Describes features of the equipment, its application and operation. Illustrated with photographs, line drawings and charts showing efficiency and regulation curves for various sized units. Specification guide for d-c power supplies and exciters also is included, as well as complete rating charts and dimensions. General Electric Co.

Capacitors **230**

Information on fixed paper-dielectric capacitors is provided in 16-page bulletin GEC809. Describes operation and features of the equipment, its application and operation. Illustrated with photographs, line drawings and charts showing the derating for a-c and d-c applications. General Electric Co.

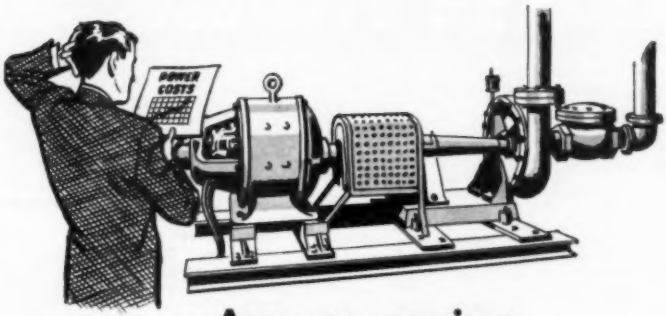
Capacitors **231**

Industrial and other type mica capacitors are thoroughly covered in 60-page catalog 420-421. Contains a wealth of electrical, physical and application data in detailed and convenient manner. Five pages of informative technical data on selection, use and method of specifying are included. Detailed dimensional drawings are given. Cornell-Dubilier Electric Corp.

Mercury Switches **232**

Condensed catalog HG-1 on line of mercury switches covers five most popular designs along with selection and

(Continued on page 30)



Are you paying

OLD-AGE COMPENSATION

for your obsolete pumps?

Check these three factors and see how much you can save by replacing outdated pumping equipment!

CHECK YOUR POWER COSTS and compare the efficiency and power requirements of your old pumps with those of modern I-R pumps. You may be amazed at how much you can save in power alone by replacing obsolete pumping equipment with today's more efficient I-R pumps. When one company recently replaced two old units with new I-R pumps the power bill dropped immediately from $1100 to $800 a month—*a saving of $3600 a year in power consumption alone.*

CHECK YOUR MAINTENANCE COSTS and see just how much it's costing you in both time and new parts to keep your old out-of-date pumps in operating condition. Today, lower maintenance is more important than ever before when it comes to keeping down your operating costs. And you'll find that *ease of maintenance—and less of it*—is inherent in the design and construction of I-R pumps. That's why they'll make such a big difference in your pump maintenance costs.

CHECK YOUR PRODUCTION CHARTS—They'll show you if your operations have lagged because of excessive "down time" brought on by pumps that can no longer keep pace with the modern high-speed processes of today. A higher availability status for your pumping equipment means higher production. You can depend on I-R pumps for continuous service because they're job engineered, *with design, construction, and materials to meet each specific application.*

Your nearest Ingersoll-Rand engineer will be glad to make a study of your present pumping equipment. He can help you determine if you have any pumps in service that can profitably be replaced by more modern, efficient I-R units.

Ingersoll-Rand

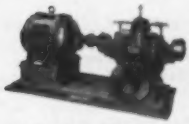
Cameron Pump Division
11 BROADWAY, NEW YORK 4, N.Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

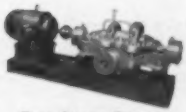
532-10

There's a COST-SAVING I-R PUMP for every liquid-handling job!

Motorpumps
Capacities to 1800 gpm
Pressures to 260 psi



Single-Stage Pumps
Capacities to 50,000 gpm
Pressures to 150 psi



Two-Stage Pumps
Capacities to 2200 gpm
Pressures to 450 psi

Multi-Stage Pumps
Capacities to 3000 gpm
Pressures to 3000 psi

Vertical Pumps
Capacities to 80,000 gpm
Pressures to 1500 psi

New bulletins and catalogs

(Continued from page 28)

application aids, and complete electrical ratings and data for use of these switches in both a-c and d-c applications. Micro Switch Div., Minneapolis-Honeywell Regulator Co.

Electronic Tubes **233**

Designed for industrial use, 28-page booklet furnishes complete technical specifications and information on hundreds of special purpose electronic tubes used in such various industrial applications as control, processing, counting, sorting, weighing, measuring, detecting, and communications. Please write direct, mentioning this publication, to Milo Radio & Electronics Corp., 200 Greenwich St., New York 7, N. Y.

ELECTRICAL HEATING UNITS

Immersion Heaters **234**

"Packaged" electric heaters—immersion, circulation and other heaters that have built-in controls are covered in 4-page bulletin. Economical advantages are described and some applications listed. Typical installation photograhs show the units at work. Edwin L. Wiegand Co.

Heating Elements **235**

Thin, flat, sheathed electric heating elements suitable for a variety of industrial applications are presented in 4-page catalog 91951. Discusses design and gives helpful information on selecting the proper element. Wattage information is given in tabular form. Diagrams show dimensions and terminal details along with details on bending the heater elements. Syntron Co.

ELECTRICAL INSULATION

Industrial Tapes **236**

Ingenious industrial catalog in the form of five file cards in a cardboard folder, provide information on industrial tapes. Cards are labeled "General Purpose Tapes", "Electrical Tapes", "Special Purpose Tapes", and "General Information". Across each card are sample strips of the tapes described, along with technical specifications, general information on uses, etc. Polyken Industrial Tape, Dep't of Bauer & Black.

FANS AND BLOWERS

Ventilating Fans **237**

Various types of industrial ventilating fans for removing smoke, heat, steam and fumes are illustrated and described in series of data sheets numbered 973 through 982. Capacities range from 850 to 58,500 cfm. Dimensions, specifications and recommendations given. Chelsea Fan & Blower Co., Inc.

Ventilation Guide **238**

Helpful guide covering general problems in industrial ventilation gives economical solutions. The 16 pages of information include chapters on types of ventilation, air velocity, system pressures, certified ratings, fan types, selection, do's and don't's, and resistance calculations. Informative tables, charts and diagrams provide a great deal of engineering data. Chelse Fan & Blower Co., Inc.

Blowers **239**

Axial flow, positive pressure blowers for handling gas or air under pressure or vacuum are presented in 12-page bulletin 51759. Cross section shows principal component parts and photographs portray various types and models. Capacity tables and specifications along with charts showing test results are given. List of applications and description of accessories included. Read Standard Corp.

FUELS & FIRING EQUIPMENT

Combustion Equipment **240**

Compact and comprehensive bulletin illustrates and describes complete line of burners, mixers, valves and blowers used in gas combustion for industrial purposes. One page is devoted to gas and oil-fired steam boilers and furnaces for the process industries. Phamphlet is designed to show the wide variety of products, and the range of sizes in which each is obtainable. More detailed bulletins on specific equipment are available. Eclipse Fuel Engineering Co.

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INSTRUMENTS FOR MEASURE OF ELECTRICITY

Measuring Instruments **241**

Information on "how to select" electrical measuring instruments is provided in 30-page booklet B4696. Seven basic selection factors are explained; types of instruments are listed; and, four typical selection problems are solved. Complete lines of portable, switchboard, panel, recording, and socket instruments are described and illustrated, and functions of each are explained. Descriptions of instrument auxiliaries are included. Westinghouse Electric Corp.

Frequency Recorder **242**

Two-page data sheet 9.1-8 describes frequency recorder designed for measuring and recording the frequency of electrical power production. Complete engineering specifications and operating characteristics including circuit diagrams and illustrations of the instrument along with other data included. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Synthetic Lubricants **243**

Booklet F7404, 8 pages, on synthetic lubricants describes their properties and advantages for high-temperature applications. How to use these products on all equipment operating at high temperatures is presented in detail. Carbide and Carbon Chemical Co.

MATERIALS OF CONSTRUCTION

Copper Alloys **244**

The word "brass" as it is commonly used covers a wide range of copper base alloys, each of which has differences and particular advantages. To help industry to distinguish between the alloys a 4-page folder lists 65 commonly used brass and copper alloys, along with their composition, properties, forms and typical uses. Bridgeport Brass Co.

Forgings **245**

Handy reference booklet B9 provides 12 pages of illustrations to show what copper and copper alloy die pressed forgings are . . . what they can do . . . what they have already one . . . what can be expected of them. Contains tabulation of physical properties of copper and copper alloys suitable for forgings. The American Brass Co.

Nickel Irons **246**

"Engineering Properties & Applications of Ni-Resist" is a 36-page bulletin describing eight types of austenitic nickel alloy cast irons that offer unique combinations of properties. Applications and comparative service data in many industrial fields are presented. The booklet is well illustrated with photographs, tables of properties and corrosion data on nearly 400 conditions. The International Nickel Co., Inc.

MECHANICAL POWER TRANSMISSION

Driveshafts **247**

Bulletin gives complete data and specifications on radial driveshafts with spline-jointed tubular shafts; universal driveshafts with one-piece tubular shafts; and universal driveshafts with spline-jointed tubular shafts. Also provides a working table of maximum recommended lengths and speeds. Morse Chain Co.

Speed Reducers **248**

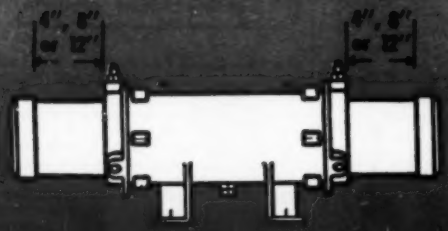
Pocket-size, 96-page catalog gives complete engineering data on how to select the proper speed reducer to fit requirements, including horsepower ratings, ratios and installation graphs. Abart Gear & Machine Co.

Gear-Type Couplings **249**

Catalog 501 explains the advantages and features of gear-type coupling with fully crowned teeth. Shows how the unit may be used to solve wide range of special power transmission problems. Contains data on shaft sizes, and speed and load capacities. American Flexible Coupling Co.

(Continued on page 32)

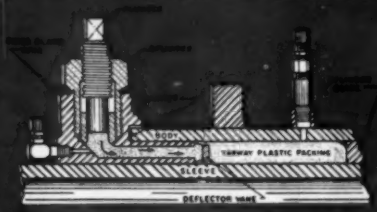
YOU NEED FEWER JOINTS



With Yarway Gun-Pakt slip-type expansion joints you need *fewer* joints than with other types, because each sliding sleeve has a traverse of 4", 8" or 12" ... maximum expansion being 24" for a double-end joint.

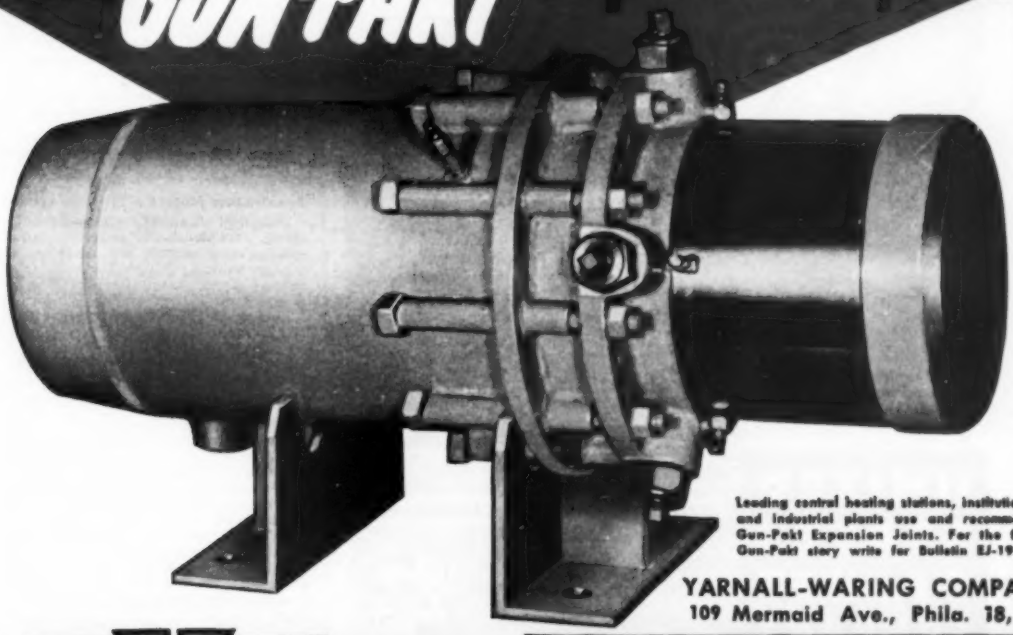
For example, one single-end Yarway Gun-Pakt joint with an 8" traverse is all that is needed for a 200 ft. run of steel pipe carrying saturated steam at 250 psi.

AND LESS MAINTENANCE



No need for shutdowns. Yarway Gun-Pakt Joints are serviced under full steam pressure. Just insert a plug of Yarway plastic packing, twist a wrench, and the job is done. Maintenance and production members are saved!

with GUN-PAKT expansion joints

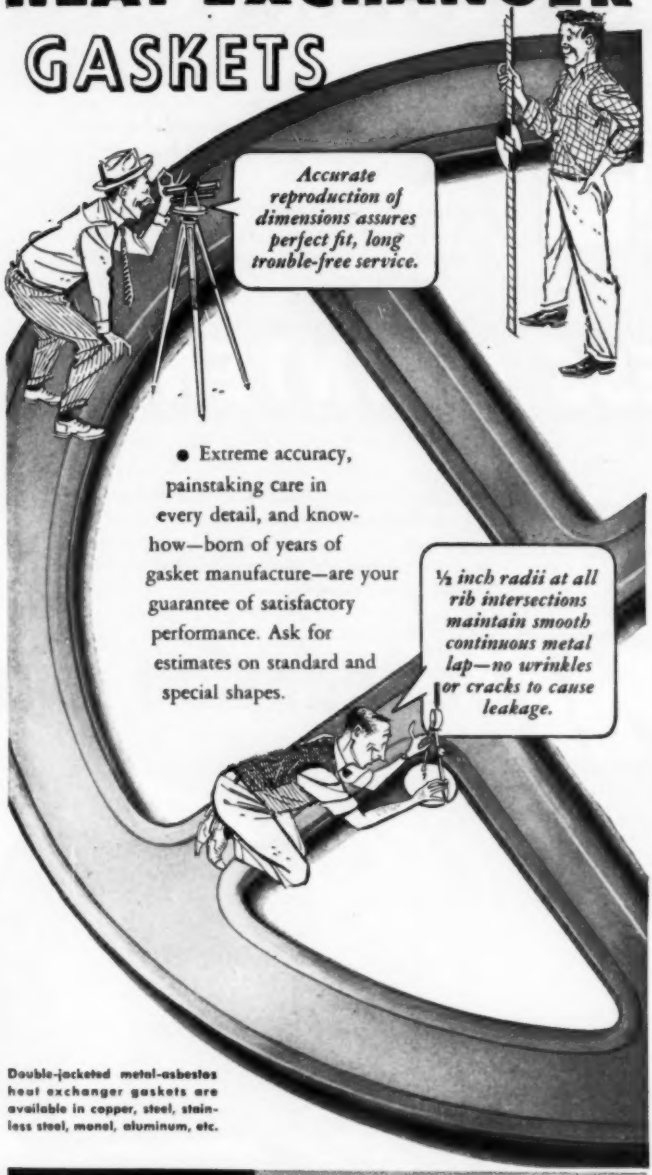


Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
109 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

HEAT EXCHANGER GASKETS


Accurate reproduction of dimensions assures perfect fit, long trouble-free service.
• Extreme accuracy, painstaking care in every detail, and know-how—born of years of gasket manufacture—are your guarantee of satisfactory performance. Ask for estimates on standard and special shapes.
½ inch radii at all rib intersections maintain smooth continuous metal lap—no wrinkles or cracks to cause leakage.

Double-jacketed metal-asbestos heat exchanger gaskets are available in copper, steel, stainless steel, monel, aluminum, etc.

UNITED STATES GASKET COMPANY

670 N. 10TH STREET, CAMDEN, N.J.

LEADING FABRICATORS OF "TEFLON" FOR THE CHEMICAL, PROCESS AND ELECTRONIC INDUSTRIES

New bulletins and catalogs

(Continued from page 30)

Variable Speed Pulleys **250**

Engineers with variable speed problems may find 30-page catalog 651 helpful. Contains complete listing, description and engineering data on line of variable speed pulleys, companion sheaves, adjustable standard and countershaft motor bases, tilting motor bases and V-belts. Includes discussions on design and construction along with operating principle. Gives data on drive selection and shows numerous installation photos. Available in 14 horsepower ratings. Gerbing Mfg. Corp.

MOTORS AND GENERATORS

Motor Controls **251**

Essential data on complete line of a-c and d-c motor starters, motor centers, contactors, relays and other accessories are contained in 88-page digest on motor controls. Included are open and closed views of the units, general descriptions, applications, enclosures, outline dimensions, catalog numbers and list prices. Indexing system simplifies the locating of specific items. The Clark Controller Co.

HOW TO REQUEST FREE BULLETINS

Each paragraph in this section is numbered —beginning with number 200. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out, and mail. Our Reader Service Department will handle your request promptly

Synchronous Motors **252**

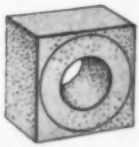
Standard construction features of low speed, coupled-type pedestal-bearing synchronous motors are described in 6-page bulletin O5B7648. Available in ratings approximately 100 hp and larger at speeds of 450 rpm or less. Motors of 1.0 power factor or 0.8 or better leading power factor are available. Applicable for direct-coupled drives with widely varying torque requirements. Allis-Chalmers Mfg. Co.

Induction Motors **253**

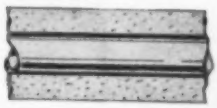
Large, end-shield bearing, squirrel-cage, induction motors are described in 6-page bulletin 05B7542A. Applications range from central station auxiliary to general industrial drives and are available in ratings and speeds up to 1750 hp at 1800 rpm, according to the booklet. Although construction features are listed, the bulletin points out that numerous mechanical and electrical modifications are available. Allis-Chalmers Mfg. Co.

(Continued on page 34)

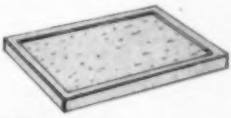
We're finding new uses every day for versatile **KAOCAST**



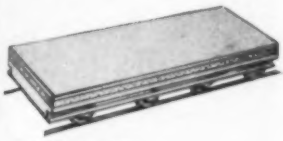
KAOCAST Burner Blocks



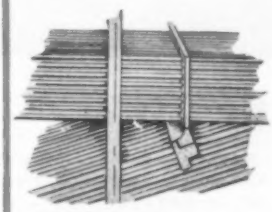
KAOCAST Covering for Water Cooled Furnace Tubes



KAOCAST Door Lining



KAOCAST Car Top



KAOCAST Boiler Baffles

Even our Field Engineers are surprised to discover the amazing variety of uses for versatile Kaocast. This unique 3000 degree refractory castable has been put to work in scores of imaginative applications where it has paid off in lower installation costs, faster repairs, longer service life. Here are a few examples:

- **Kaocast replaced firebrick in door linings... lasted 3 to 6 times as long, cut costs in half.**
- **In a tunnel kiln, ordinary castables used for covering car tops crumbled after a few trips. Kaocast stayed on the job for 30 trips without deterioration.**
- **Versatile Kaocast proved "better than anything previously used" for piers of a stoker-fired boiler.**
- **This jack-of-all-refractories performs so well that one central station keeps a large stock on hand for miscellaneous jobs.**

Are you missing a money-saving opportunity to use versatile Kaocast? Ask your B&W Field Engineer to give you additional facts and figures . . . to help you profit with Kaocast. • KAOCAST is another important refractories development by B&W engineers who have continuously established new standards in industrial furnace refractories for the past 30 years.

BABCOCK & WILCOX

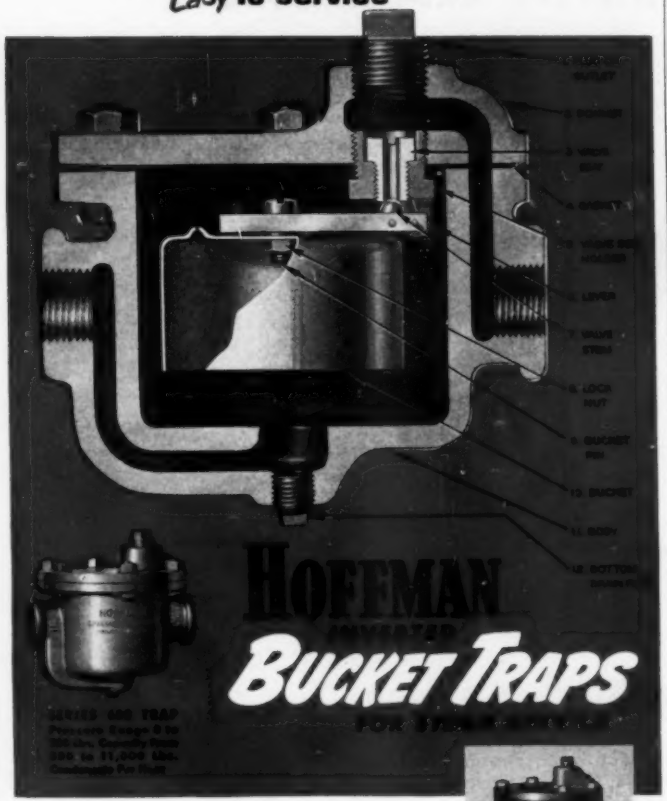
THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

R-401

B&W REFRACTORIES PRODUCTS—B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

NOTED FOR *Efficiency...*

This simple mechanism is *Easy* to install... *Easy* to service



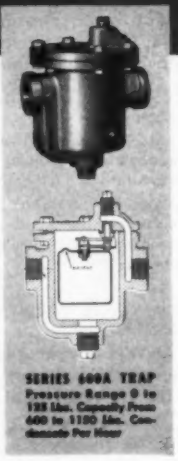
HOFFMAN Bucket Traps operate intermittently and are particularly applicable to draining condensate and air from steam lines or equipment where large quantities of air and condensate must be discharged. They are easily inspected, cleaned and serviced by merely removing the cover assembly.

Straight-through pipe connections permit close-to-floor installation.

All working parts are connected to the bonnet and are removable with it for service without breaking pipe connections.

These are features of design appreciated by the maintenance man in saving man-hours when manpower is costly and scarce.

Hoffman Bucket Traps are adjustable to a wide choice of pressures, simply by changing valve seats. Send today for full information, no obligation.



HOFFMAN SPECIALTY CO., Dept. P-9, 1001 York St., Indianapolis 7, Ind.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.

New bulletins and catalogs

(Continued from page 32)

PACKAGED STEAM GENERATORS

Steam Generators **254**

Four-color 16-page booklet on packaged steam generators, profusely illustrated with photographs, cut-away and schematic drawings, describes in detail construction and operating principles. Charts and tables provide essential data, dimensions, specifications and test results. Explains such subjects as induced draft; dry steam; 4-pass downdraft design; 5 sq. ft of heating surface per bhp; flexibility of operation; and oil, gas, and combination gas/oil burning equipment. Superior Combustion Industries, Inc.

Steam Generators **255**

Information on units for steam or hot water use is presented in bulletin 1218. High or low pressure units from 15 to 500 hp are described. Gives details on special burner design and shows how quickly the unit can be changed over from oil to gas firing. Orr & Sembower, Inc.

HOW TO REQUEST FREE BULLETINS

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Steam Generators **256**

Engineers concerned with providing heat, power or hot water may find it helpful to study the installation, operating and other advantages offered by "steam in a package". Bulletin ID51-115, 12 pages, presents facts on self-contained steam generator of three pass, forced down draft, horizontal fire tube design. Operating features are pictured and described, and information on sizes and fuels is given. Photos illustrate case histories showing actual dollar savings. Specifications and ratings table included. York-Shipley, Inc.

PACKINGS & GASKETS

Asbestos Packings **257**

Braided and twisted asbestos packings designed for use on valve stems, are illustrated and described in 8-page bulletin. Gives service recommendations; lists standard sizes, specifies standard packages and gives approximate weights of the several types. Raybestos-Manhattan, Inc., Packing Div.

Duck & Rubber Packings **258**

Various types of duck and rubber packings including low pressure, cross expansion, hydraulic, hollow core, round

(Continued on page 150)

NONPAREIL
TRADE MARK
Turbine Oil

For economy in the long run

IN the case of two 12,500-KW turbines serving a midwest utility, the "long run" already has covered fifteen years. During that period, the original fills of NONPAREIL Turbine Oil have maintained an acidity below .10 mg. KOH/gm., with never any need to remove the oil for treating or for cleaning of the turbine lubricating systems. That's lubrication economy!

There's no time limit on the "long run," however, when NONPAREIL Turbine Oil is used. A written guarantee—given with each fill of NONPAREIL—is your assurance that it will last as long as your turbine.

For economy in your own turbine lubrication, make your next fill NONPAREIL. Let a Standard Oil lubrication specialist show you the facts, including service records covering up to twenty-three years continuous operation of NONPAREIL Turbine Oil. Contact your nearest Standard Oil Company office. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

STANDARD OIL COMPANY

STANDARD

(Indiana)

Longer bearing life on the "milk run"

Here's evidence of the superior lubrication that a midwest milk processing plant is getting through the use of STANOLITH Grease No. 42. This pump arbor and its anti-friction bearings have been run for a year under conditions of extreme dampness . . . yet there is no appreciable wear, no corrosion.

High maintenance costs and frequent replacement of bearings in both electric motors and pumps had been a direct result of excess humidity in the plant, until a Standard Oil lubrication specialist recommended the use of STANOLITH. After a test run, it was adopted throughout the plant. Now, after a full year of operation, STANOLITH Grease No. 42 has meant a 50 percent reduction in bearing replacements. Corrosion troubles have been eliminated.

STANOLITH's extreme resistance to water has payed off for this user. For your own application, STANOLITH's heat-resistant properties may be most important. Why not discuss the problem with your own Standard Oil lubrication specialist? Just call your local Standard Oil office for his service. Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

STANOLITH
TRADE MARK
Greases

What's your problem?

R. L. Hansen, of Standard's Green Bay office, is the lubrication specialist who recommended STANOLITH Grease No. 42 and helped this processor make important savings.

He and other lubrication specialists are located throughout the Midwest. They are ready to give you prompt and expert attention. If you have a lubrication problem, the lubrication specialist nearest you is the man to see.

He has been specially trained for his job in Standard Oil schools, and in addition, he has plenty of practical experience which qualifies him to give you thorough and reliable service. A phone call to the nearest Standard Oil office is all that's necessary to place him at your service. When he calls, ask him to discuss with you the performance records of the following fine products:

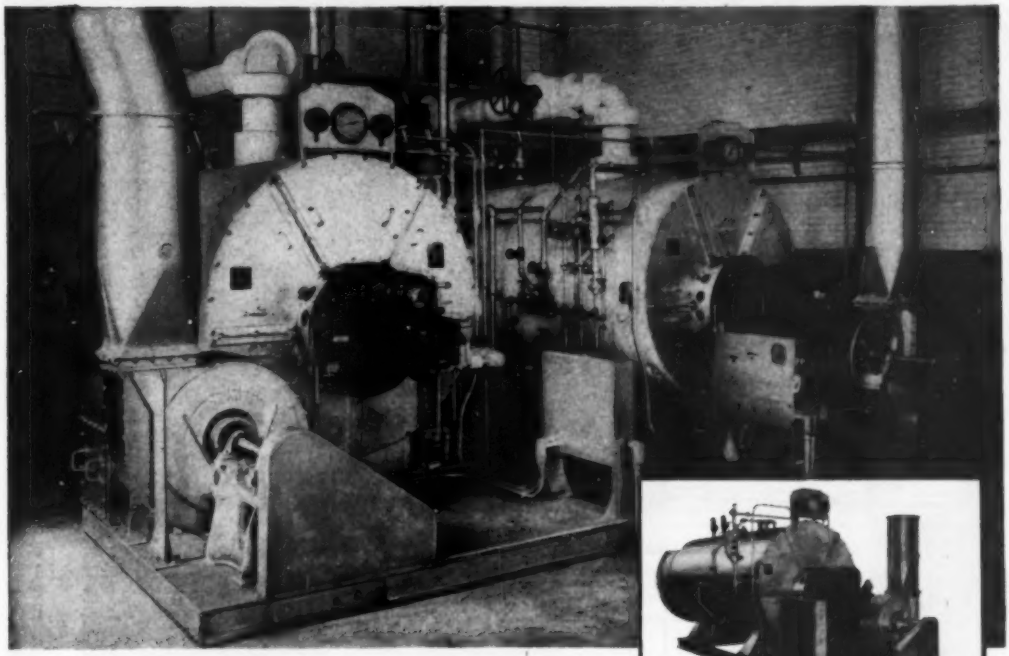
STANOIL Industrial Oils—This general-purpose line of oils provides cleaner operation of hydraulic units and supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

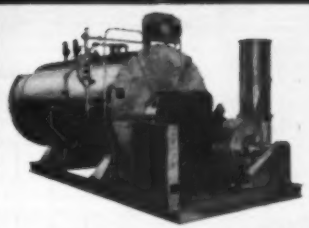
CALUMET Viscous Lubricants—On open gears and wire ropes, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better internal lubrication of wire rope.

STANDARD OIL COMPANY STANDARD (Inaiana)

Habitant Soup Co. Cuts Steam Costs 35%

with Preferred Units





Here's what the Habitant Soup Co. of Manchester, N. H., reports: *"More than two years ago we installed two Preferred Unit Steam Generators and we're frankly amazed at the small amount of fuel they consume to produce more than enough steam for our requirements. In fact, they cut our fuel bills by 35%.*

"Maintenance of the Preferred units is practically nil because they are fully automatic. We're glad to report that both boilers are working like a charm."

There are a host of good reasons for these savings. Fuel costs go down, for example, because Preferred Unit Steam Generators offer fully automatic operation with inexpensive No. 6 oil. But Preferred units assure *even more* than appreciable, immediate returns on your investment. They are designed to give *continuing economical* operation for at least 25 years.

For proof, read the 25-year features in the panel at right. For full details, send for Bulletin 1000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

8 PREFERRED 25-YEAR FEATURES

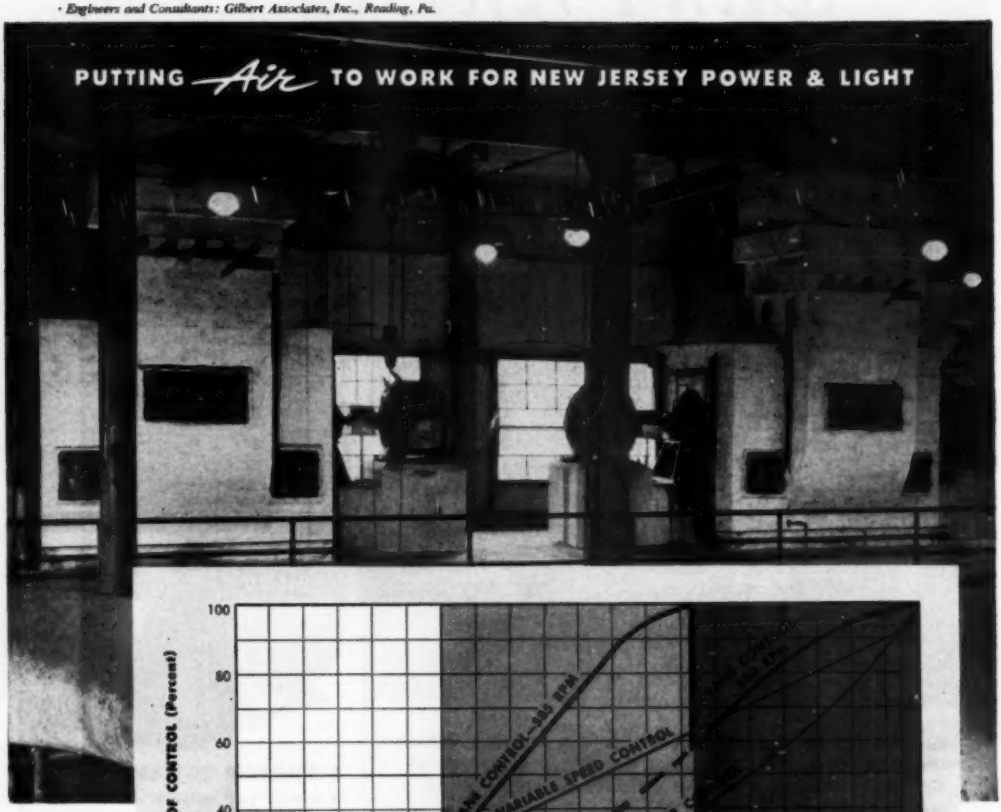
- **4-pass, high velocity, gas travel—minimizes tube cleaning maintenance by self-cleaning action.**
- **Staggered tube construction—minimizes the possibility of tube pitting, even at low firing rates.**
- **Preferred-built 4700 rpm Horizontal Rotary Oil Burner—assures fully automatic operation even with No. 6 oil.**
- **Anti-stress deck for tube sheet protection.**
- **Self-cleaning *induced draft* fan with air cooled shaft and bearings—built to last 30 years.**
- **Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.**
- **Special *precipitator* developed by Preferred as aid to safe and clean operation.**
- **Dual purging cycles for positive elimination of gas stratification.**

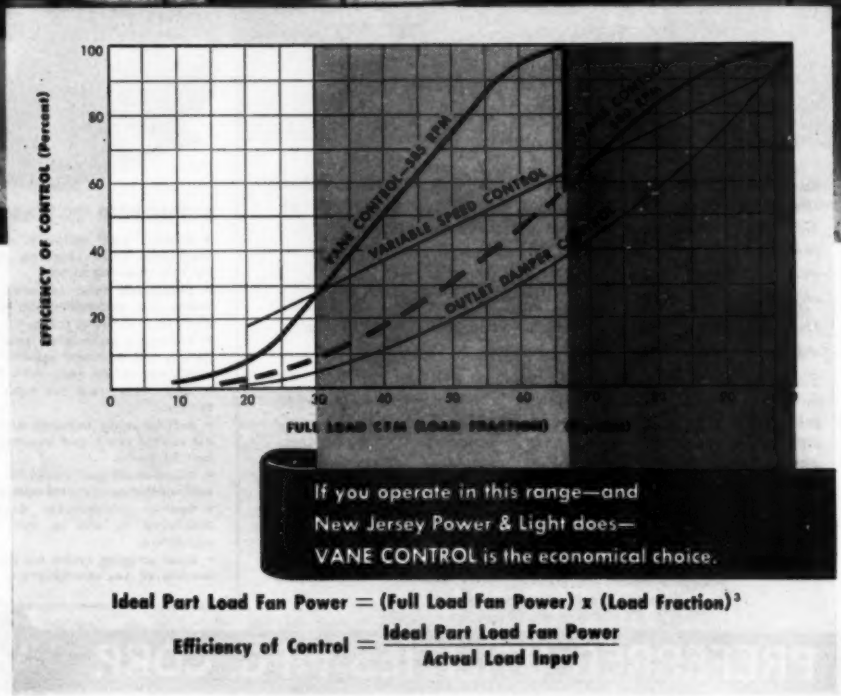
PR-101

PREFERRED UTILITIES MFG. CORP.

For ECONOMY

· *Engineers and Consultants: Gilbert Associates, Inc., Reading, Pa.*





$$\text{Ideal Part Load Fan Power} = (\text{Full Load Fan Power}) \times (\text{Load Fraction})^3$$

$$\text{Efficiency of Control} = \frac{\text{Ideal Part Load Fan Power}}{\text{Actual Load Input}}$$

Plus FLEXIBILITY...

STURTEVANT

VANE CONTROL®

WITH TWO-SPEED MOTORS

When New Jersey Power & Light selected Sturtevant Induced Draft Fans for the new No. 3 boiler in their Gilbert Station at Milford, they wanted greater flexibility *plus* economy over a wide range of operation. They achieve this by using the two TURBOVANE® ID Fans shown at left, each drawing 192,000 cfm at 16.9" static pressure and 315°F. Each fan is equipped with power-saving VANE CONTROL and driven by two motors—one at 880 rpm and one at 585 rpm. As plotted on the accompanying chart, this arrangement provides the maximum economy of operation over their entire load range, with greater flexibility.

This installation illustrates once again the dependable, economical performance which central stations and industrial power plants have come to recognize as the outstanding features of Sturtevant Mechanical Draft equipment. These features explain the many *repeat* orders for Sturtevant Forced and Induced Draft Fans from satisfied customers.

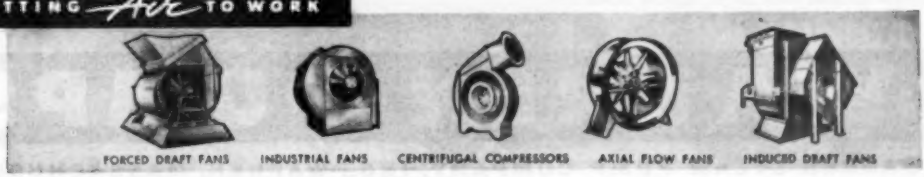
If you are interested in *putting air to work* efficiently, contact your nearest Westinghouse-Sturtevant Office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

YOU CAN BE SURE...IF IT'S

Westinghouse

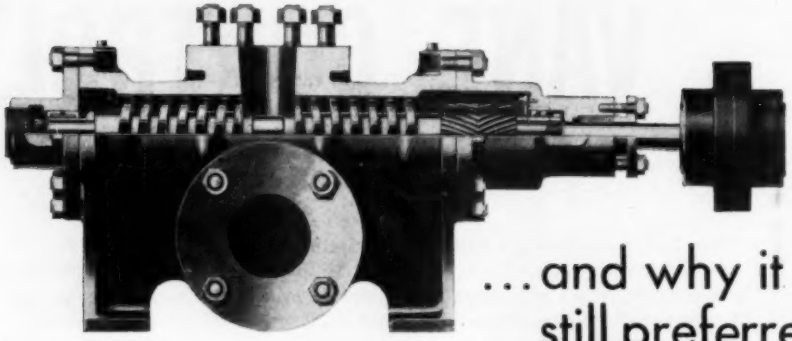
PUTTING *Air* TO WORK

J-80236A



QUIMBY

...the Original Screw Pump



...and why it is still preferred

100% Anti-friction bearing equipped. Due to their rolling action and minimum lubricating requirements, anti-friction bearings maintain their original clearances without appreciable wear. No hydraulic shock or discharge pressure loads on the bearings because Warren-Quimby Screw Pumps are 100% balanced axially.

Quadruple non-slip screws. A specially generated curvature is now used, producing a straight line contour between screws, essentially eliminating all slippage between these elements. Closer clearances without metallic contact insure higher efficiencies over longer periods.

Balanced power, pulseless discharge. No special foundations or bolting required for successful operation. Smooth running and quiet, with a minimum of churning or foaming of liquid handled.

No stuffing box troubles. In general, there are no packing troubles with Warren-Quimby Screw Pumps. By using sets of opposed intermeshing pumping screws, the flow of liquid is from each end toward the center, insuring suction pressure only on the stuffing boxes.

Herringbone Driving Gears. Smoother flow of power from the driving shaft to the idler shaft is accomplished by multi-tooth, precision cut, full herringbone gears. These gears are so positioned and timed as to maintain a definite clearance between the pumping screw elements.

Positioning Bearing. A fixed ball or roller bearing on the drive shaft effectively absorbs all external thrust loads. This permits full floating screw elements, free to expand at elevated temperatures without harm to the pump.

Interchangeability. All parts, excepting the body and length of screws and shafts, are interchangeable with corresponding sizes in the gear-in-head and external bearing designs.

The most complete line of Screw Pumps in the industry.

Insist upon the original...now owned, manufactured, marketed, serviced and guaranteed by Warren . . . one of America's pioneers of the pump industry. Write for bulletin S-204.

WARREN QUIMBY PUMPS

PG-1

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

SILENTLY, but ruthlessly *(even as you are reading this)* rust is gnawing away at machines, tanks, fences, pipes, fire escapes, metal sash, stacks —every rustable metal—inside and outdoors!

To protect your investment — to keep every possible pound of new steel for the defense program — to make all rustable metal surfaces last longer—*adopt rust control with RUST-OLEUM as an important part of your maintenance program.*

RUST-OLEUM stops rust! Its tough, pliable, rust-resisting film gives excellent protection that prevents rust losses under many difficult rust-producing conditions.

RUST-OLEUM can be applied *even* over rusted sufaces. It is not necessary to remove all the rust. Just use wire brush and sharp scraper to remove rust scale and loose rust. Economical and easy to use because no sand blasting or chemical pre-cleaning is required.

RUST-OLEUM can be obtained promptly from Industrial Distributors' stocks in principal cities of the United States and Canada. Anticipate your needs and order now! For complete catalog see *Sweet's*, which also lists your nearest source of supply, or write on your company's letterhead for full information.

RUST-OLEUM CORPORATION
2472 Oakton Street, Evanston, Illinois

"Rigid Economy Man!"

RUST-OLEUM
Stops Rust

Beauti... AS IT ...

Available in many
COLORS,
aluminum and white.

Wherever You are...

UNION CHAIN
is at your elbow

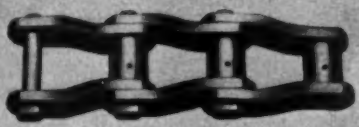
Suppose you need UNION Silent Chain

for a short center drive at unusually high speeds. If you are certain of the pitch, width, length and pinions required, write or phone your nearest Union Chain Stock Carrying Distributor listed on the facing page. It is an essential part of his service to give you the earliest possible delivery.

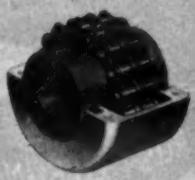
... or *suppose you need* engineering advice on the selection of a Union silent chain drive as an integral part of your own product. Then your cue is to communicate with Union Chain's nearest district office as listed at the top of the facing page. You will receive unprejudiced, competent help.

Unprejudiced because Union Chain makes all types of steel chains and is concerned only to provide each customer with the proper chain for top efficiency and minimum cost. ***Competent*** because all-round experience qualifies Union Chain specialists to make sound chain recommendations whether the application calls for silent chain, roller chain or one of the various heavy drive or conveying chains. We believe you can discuss your chain problems quite profitably with us.

UNION ROLLER CHAIN



UNION HEAVY DRIVE AND CONVEYING CHAINS



UNION
ROLLER CHAIN
FLEXIBLE COUPLINGS

UNION
SILENT CHAIN
FLEXIBLE COUPLINGS

UNION CHAIN REPRESENTATIVES

CALIFORNIA
American Chain & Gear Co.
C. A. Mobelas
5311 Pacific Blvd.
Huntington Park, California

GEORGIA
H. F. Edge
308 Walton Bldg.
Atlanta, Georgia

ILLINOIS
Union Chain & Mfg. Co.
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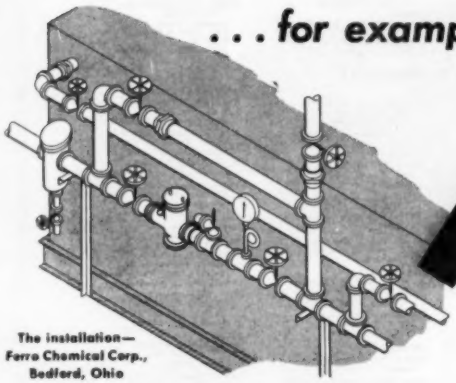

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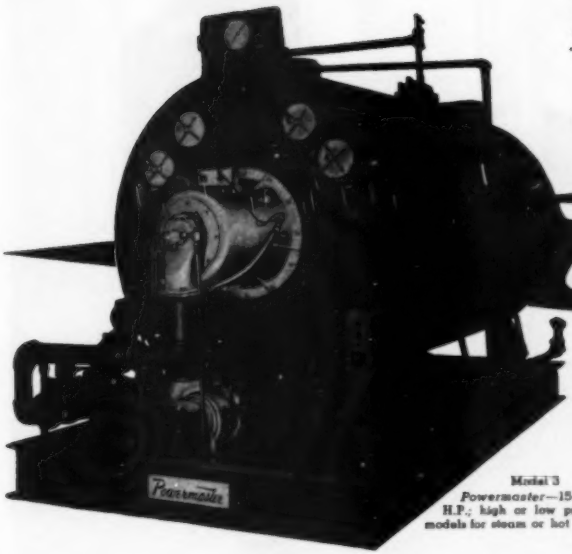

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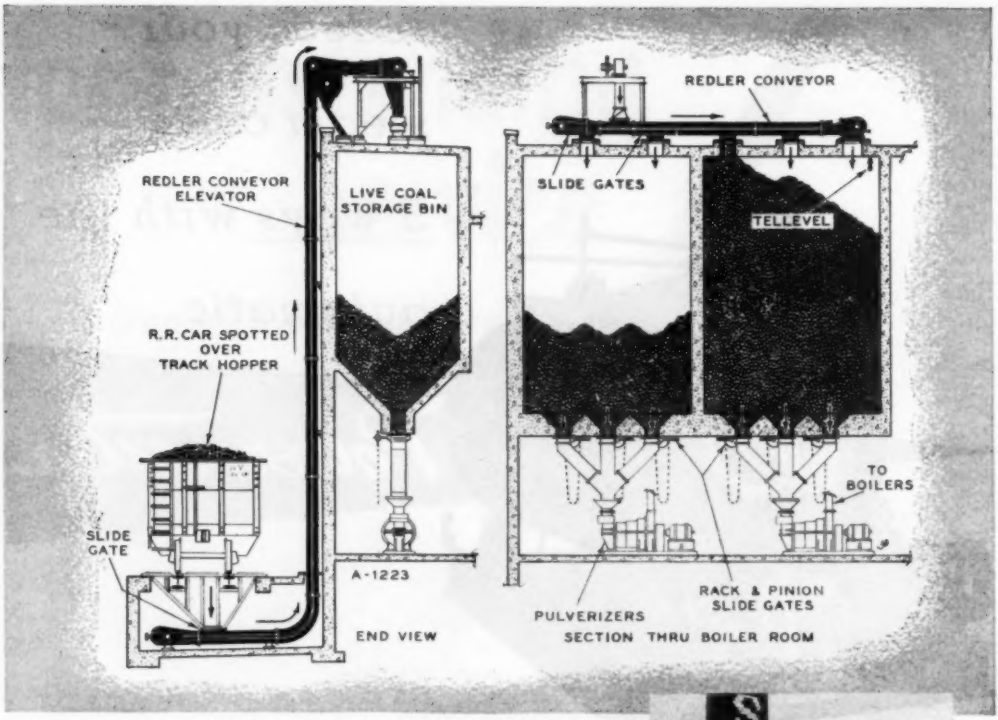

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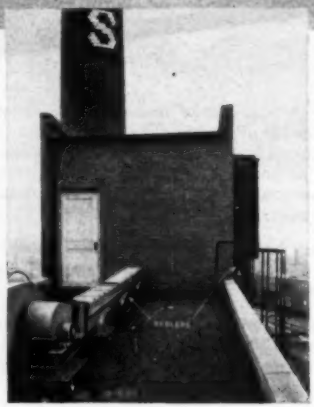

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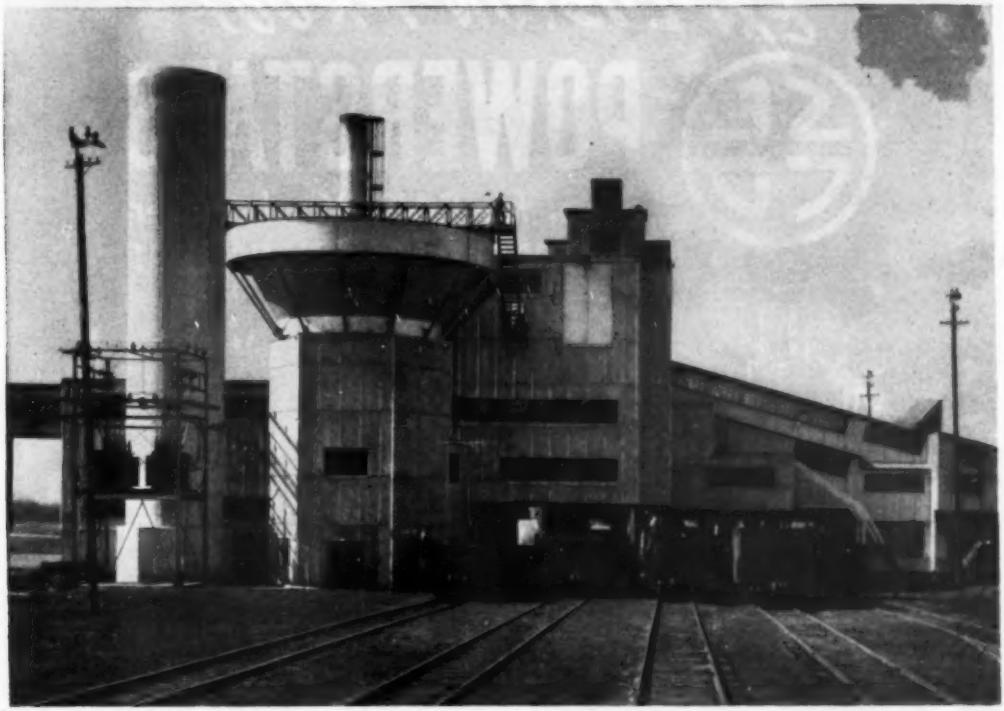

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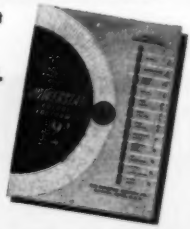

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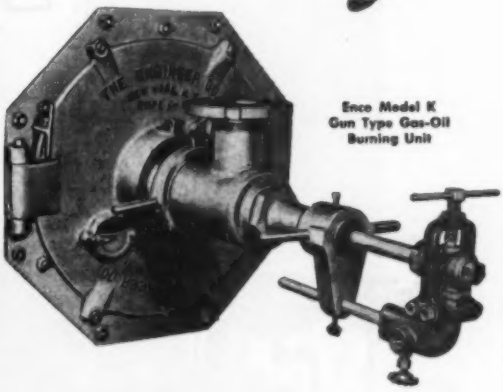

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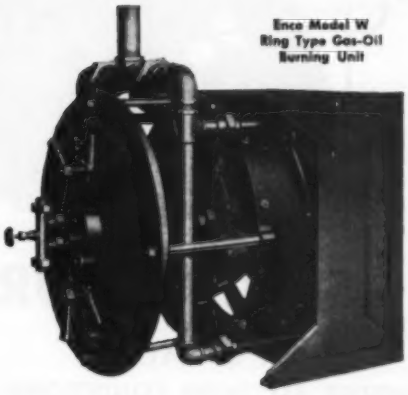

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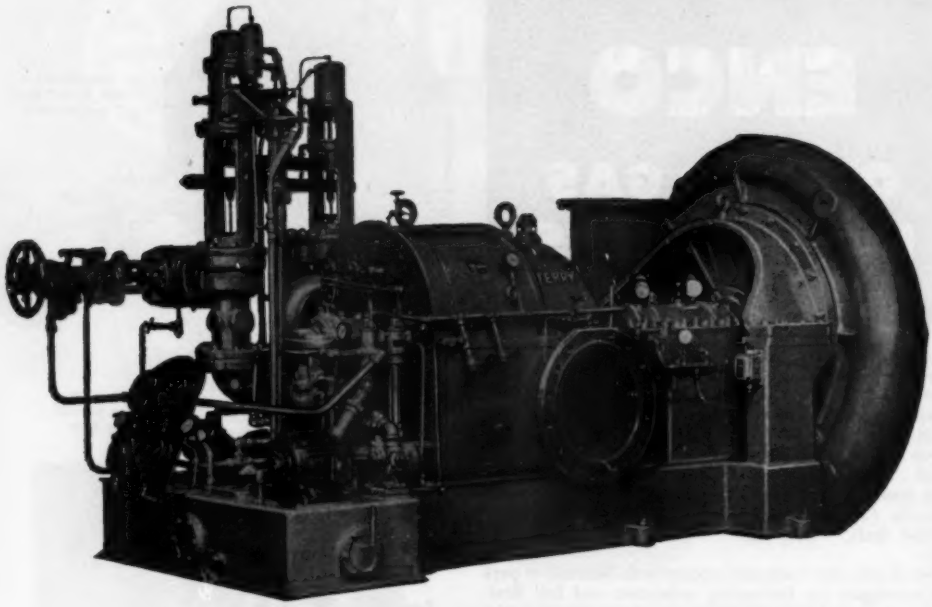

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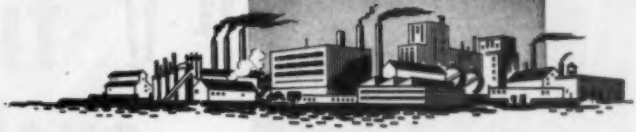

WHEN a Massachusetts company* surveyed their plant methods, they were amazed to find how much it was actually costing them to keep their machinery lubricated.

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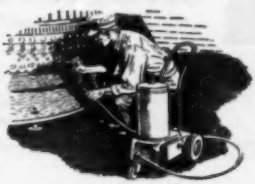
1. In transferring lubricants . . . cuts man hours 63% for every 100 pounds transferred. Eliminates mess, costly contamination.

2. In loading grease guns . . . saves 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. In applying lubricants . . . saves up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

FREE! Valuable Booklet—
"11 Ways to Cut Production Costs"...
(Simply attach to your letterhead)

ALEMITE, Dept. M-111
1850 Diversey Parkway, Chicago 14, Ill.

We'll include facts on the new Alemite Oil-Mist System, too—(OIL-MIST atomizes oil into mist, circulates it to bearings under pressure. Increases life of bearings as much as 17½ times).

Name _____

Company _____

City _____ *State* _____

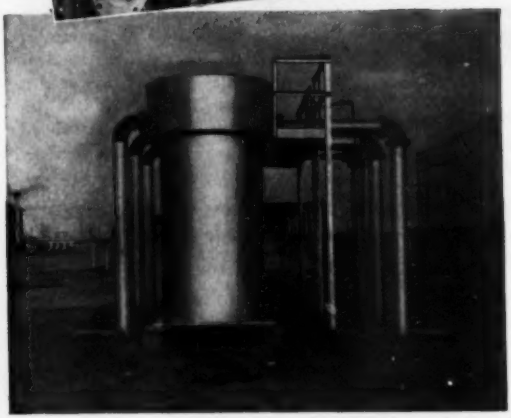
Dirty Water can't "Shut-down"...

Vogt

film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

ALOYCO No. 1105 gate valve fully jacketed for heating valve

Lasts longer in corrosive service

If the application is on a line carrying corrosive liquids, a high alloy valve will save you time and trouble. ALOYCO specializes on high alloy valves with

A. metallurgical research devoted *exclusively* to corrosive applications;

B. foundry and machine shop facilities set up for high alloy valves *only;*

C. casting and machining practices dictated by the difficult characteristics of the alloys required for corrosive services.

Success Stories from ALOYCO'S Corrosion Clinic

THE CORROSIVE: Asphalt resin.

THE APPLICATION: Sampling high-temperature, high-viscosity asphalt resin in processing of lubricating oil.

THE PLACE: A large oil refinery.

THE PROBLEM: Standard cast iron gate valves, traced with a 150 psi steam coil, did not provide uniform heating, which gave trouble in sampling. They became loaded with asphalt, which caused them to stick. When finally opened, a solid slug of asphalt would come through.

THE SOLUTION: ALOYCO fully jacketed gate valves. Valve body and bonnet jackets are connected to 150 psi steam and valves are completely lagged.

Steam-jacketed ALOYCO valve insures free-flowing asphalt resin sample.

THE RESULTS: ALOYCO valves have been in service since 1948, and are used daily for sampling. Since valve is heated uniformly in body and bonnet, the asphalt flows freely and sticking is eliminated.

THE BACKGROUND: The ALOYCO Corrosion Clinic offers aid on all sorts of problems—not just corrosion. If the service is one that should be handled by a corrosion-resistant valve, the problem—whether it be corrosion, contamination, discoloration, temperature extremes or proper application—is one for the Clinic.

Among all valve manufacturers, ALOYCO is the *largest* specializing in high alloy valves. We make *more* corrosion-resistant valves than anybody else.

Cut valve costs. Put your problem up to ALOYCO'S Corrosion Clinic.

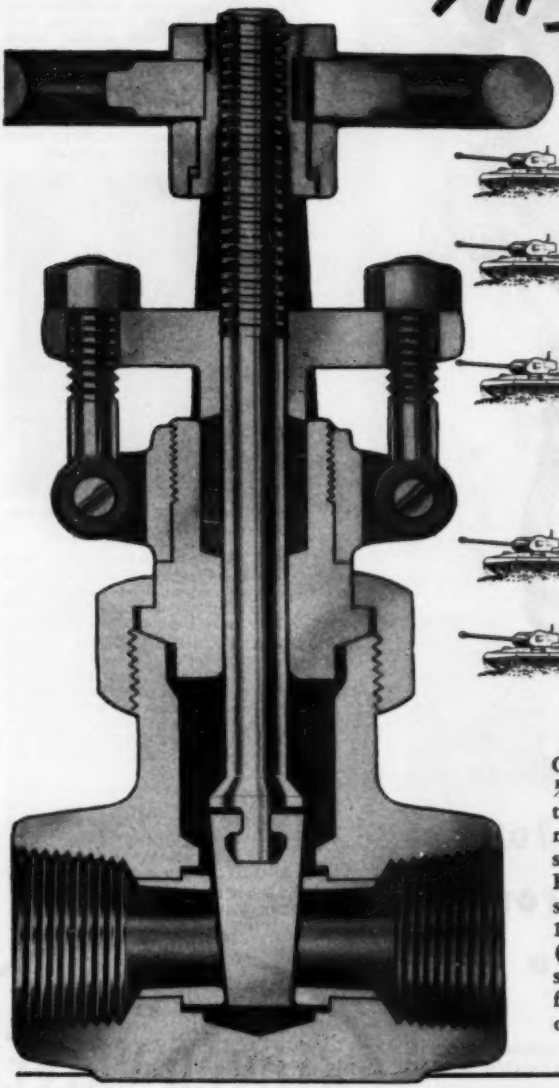
ALLOY STEEL PRODUCTS CO., INC.
1906 West Elizabeth Avenue, Linden, N. J

Longer Lasting

ALOYCO VALVES

1st in Corrosive Service

All 5 Vital Points are ARMORED



Body and Yoke are of Forged Steel, for extra strength and longer life.

Bolted Follower
with no follower threads on yoke to corrode. Follower easily tightened down any time when necessary.

Malcomized Gate Faces:
When furnished with either 12-14% or 18-8% stainless steel trim, List 960's gates are hardened by "Malcomizing," patented Chapman process. "Malcomizing" hardens to a minimum of 800 Brinnell, which minimizes seizing or galling and lengthens valve life.

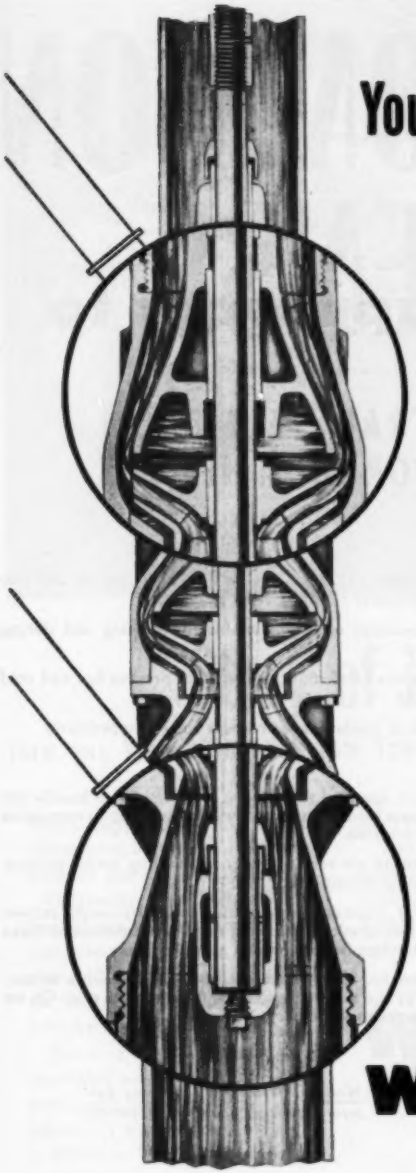
Super-Hardened Seat Rings
and wedge-faces of stainless steel help to save on repairs and replacements.

Strong Stem and Wedge Connection
Extra strength of stem-and-wedge gate connection provides protection against even unusual service stress.

Chapman List 960 is available in sizes from ¼" to 2" . . . in four different alloy-combinations of body and trim which qualify this rugged forged gate valve for many different services. Gasketed joint, or metal-to-metal. Rising stem with yoke (shown) or rising stem inside screw. Pressure range: 2000 lb. at 100°F.—380 lb. at 1000°F. (for higher pressures, specify List 990). Write for illustrated fact-sheet on List 960.

CHAPMAN'S LIST 960 FORGED Gate Valve

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS



You Can't Lose Your Bearings

when you follow the tip to buy WORTHINGTON

When you buy a vertical turbine pump, be sure the top and bottom bearings are well protected.

Here's the protection Worthington gives the bearings of *its* pump—better protection than you'll find in any other vertical turbine pump.

Bottom bearing. It's grease-packed and won't need attention for the life of the pump. Tests of grease-packed bearing versus rubber bearing show the advantage greatly in favor of the former.

Top bearing of oil-lubricated models. Seals above and below the drain ports keep out abrasives which would cause wear and damaging vibration. They also prevent water from entering the tube, which could cause emulsification of the oil and accelerated wear of the line shaft—a Worthington exclusive.

Sand collars. In water-lubricated models, sand collars at both ends of bowl assembly provide further protection by keeping abrasives away from the bearings.

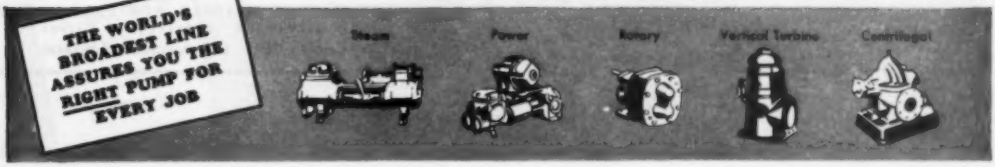
Worthington Vertical Turbine Pumps are available in sizes from 6 in. up, to handle liquids at temperatures of minus 7F. to 500F., with maximum head per stage over the entire size range.

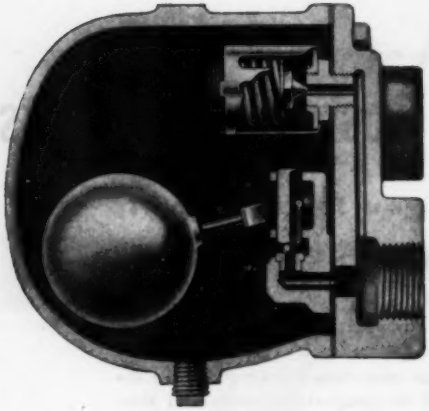
For other Worthington exclusives—such as flanged and bolted bowls in *all* sizes—write to Vertical Turbine Pump Division, Worthington Pump and Machinery Corporation, Harrison, New Jersey or Denver 16, Colorado.

WORTHINGTON

D.1.9

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB





COMMON SENSE approach to

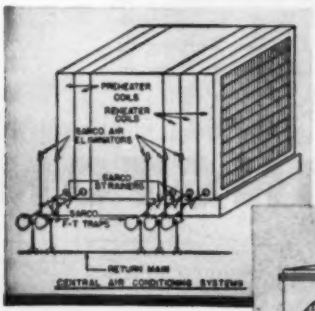
TRAP SELECTION FOR UNIT HEATERS

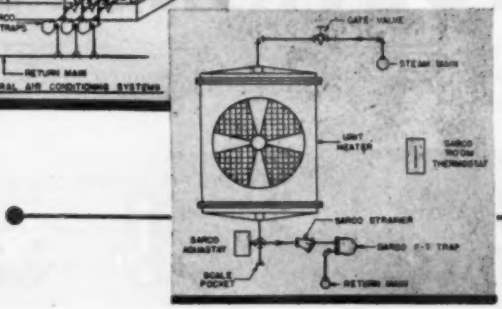
what are the requirements for efficient unit heater or blast heater drainage?

1. High starting load capacity to deal with cold air and low steam pressure resulting from peak load.
2. Free discharge of incondensables on starting and during running.
3. Continuous condensate discharge to prevent hot and cold air blasts.
4. Release of condensate at or near steam temperature.

why is the Sarco type F.T. the ideal steam trap for such heaters?

1. The float operated main valve can be sized to handle the condensate loads from the lowest pressures up to maximum design pressure.
2. The built-in air vent prevents air binding under starting or running conditions.
3. Sarco F.T. traps discharge condensate continuously, as soon as it forms—don't need to cool or to wait until steam leaks out of buckets before they fill and discharge.
4. The float level and, therefore, the valve opening is controlled by the rate of condensate flow into the trap. On no load, the valve is closed.

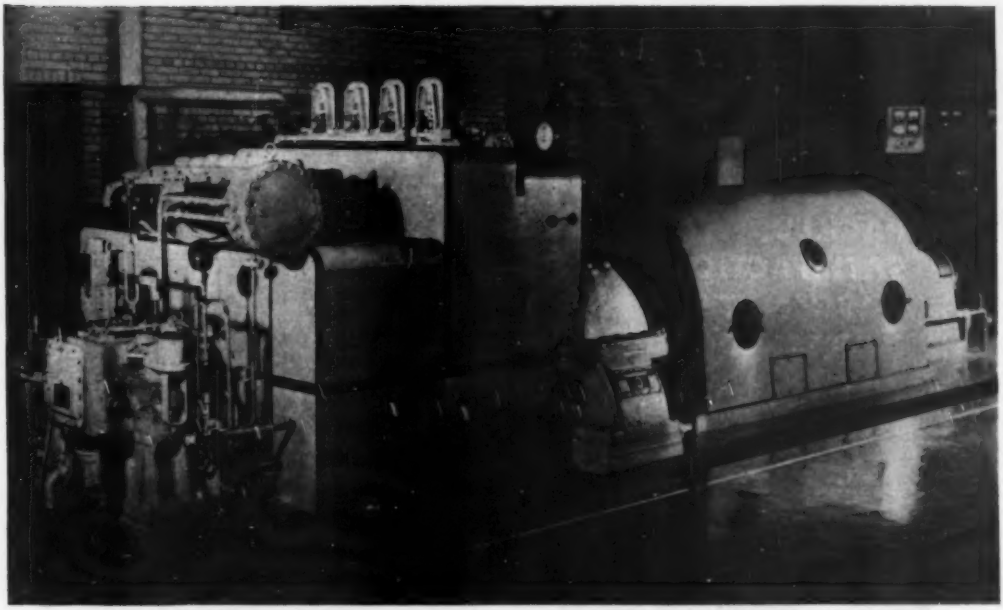




New Bulletin 455 contains full information on latest improvements.

SARCO COMPANY, INC.
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
Represented in Principal Cities
SARCO CANADA LTD., TORONTO 5, ONTARIO

335



Story of an Economy Drive

How the Worthington Steam Turbine Pays Dividends for the City of Litchfield

What happened at Litchfield, Minnesota, is a clue to a most economical power plant operation.

Originally, the Litchfield municipal power plant consisted of low-pressure boilers, a steam engine and a small turbine-generator unit. The exhaust steam is sold for municipal heating.

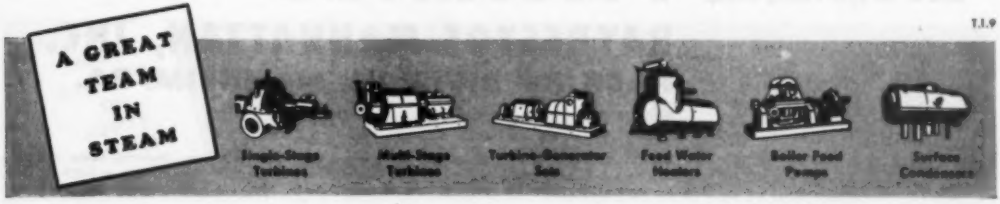
Next—a Diesel engine-driven generator was installed. The load grew, and finally, after a careful survey, it was decided to install a 3000-kw Worthington turbine generator and automatically extract steam for heating purposes.

Worthington builds steam turbines in all types and sizes—and turbine-generator sets up to 10,000-kw. For proof *there's more worth in Worthington*, call our nearest office or write to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.

WORTHINGTON

STEAM TURBINE GENERATORS

T.I.9



IT'S PACKED WITH SATISFACTION WHEN IT'S PACKED WITH R/M

You will find Raybestos-Manhattan packings and gaskets in machines like this reciprocating boiler-feed pump, and in practically every other type of fluid-handling equipment in industry. The long line of R/M packings and gaskets is relied on by experienced engineers, not only for pumps, but for valves, compressors, expansion joints, hydraulic rams, and wherever trouble-free service is essential. The R/M distributor near you will gladly help you select the right packing or gasket for your needs. Or write for the R/M Packing Catalog.

R M

PACKINGS

RAYBESTOS-MANHATTAN, INC.

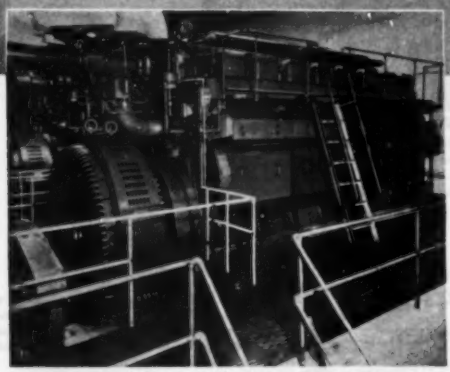
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn. Manheim, Pa.
No. Charleston, S.C. Passaic, N.J.

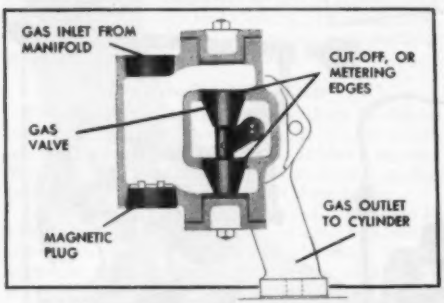
RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

They're Handling Expanding Power Loads The Fast, Low Cost Way:

Iowa Utility Company, Like So Many Others, Uses Worthington Dual Fuel Units For Uninterrupted Service On The Cheapest Fuel Available



A Worthington Supercharged Dual Fuel Engine in the Oskaloosa plant — part of the Iowa Power And Light Company System.



WORTHINGTON MICRO-METERING GAS VALVE
One for each cylinder

Used on Spark Ignition and Dual Fuel Engines — Governor controlled — Individually adjusted.

Assures: — Equal cylinder loading — Smooth running at all loads — Better speed regulation — Lower maintenance.

Full load operation, 24 hours a day, is routine performance for Worthington Dual Fuel Engines. They're designed and built to do just that — and they're doing it for power companies in communities all over the world.

They're saving money for their users every day, too, because of their Worthington-pioneered dual fuel feature that enables them to operate on gas or oil, or any combination of these fuels. Also, without losing load, they can instantly be changed over from one fuel to the other.

When gas is your fuel, only a very small amount of pilot oil is needed for ignition. Micro-metering valve (see drawing) on each cylinder provides equal distribution of gas for smooth, steady operation. Supercharging assures maximum economy through high thermal efficiency with either fuel.

BESIDES FUEL SAVINGS—

Lubrication and maintenance costs have been cut to a minimum through an effective system of "hot-spot" lubrication, according to users of Worthington Dual Fuel Engines. Why not get the whole story that proves *there's more worth in Worthington!* Write to *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

WORTHINGTON

E1-1

YOUR PARTNER IN POWER PROGRESS

WORTHINGTON-BUILT AUXILIARIES

Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,520 hp . . . dual fuel engines, 225 to 3,290 hp.

Balanced Angle Compressors

Oil Transfer Pumps

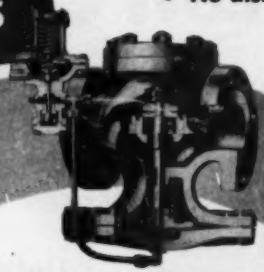
Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler

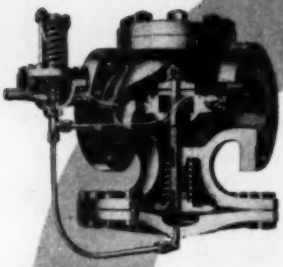
SAVE WITH SPENCE on all these jobs

Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:

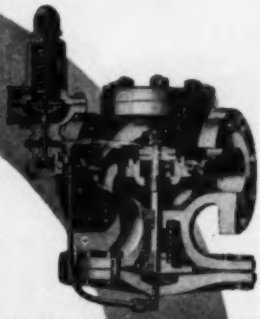
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

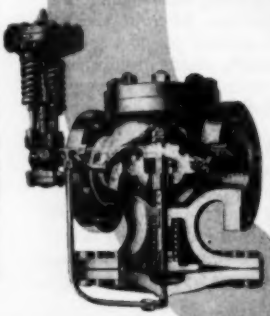


BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

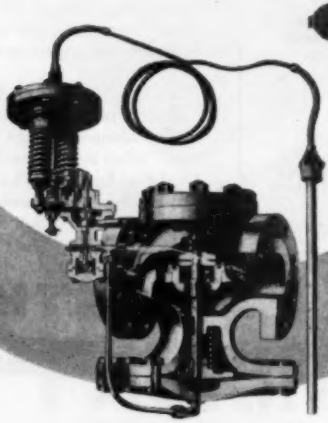


DIFFERENTIAL PRESSURE—Accurate control of delivery pressure to be constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

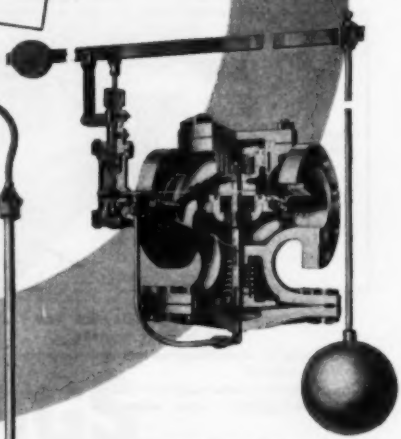
WRITE FOR BULLETIN 350
for complete details on Spence's line of automatic regulating valves



PUMP GOVERNOR—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

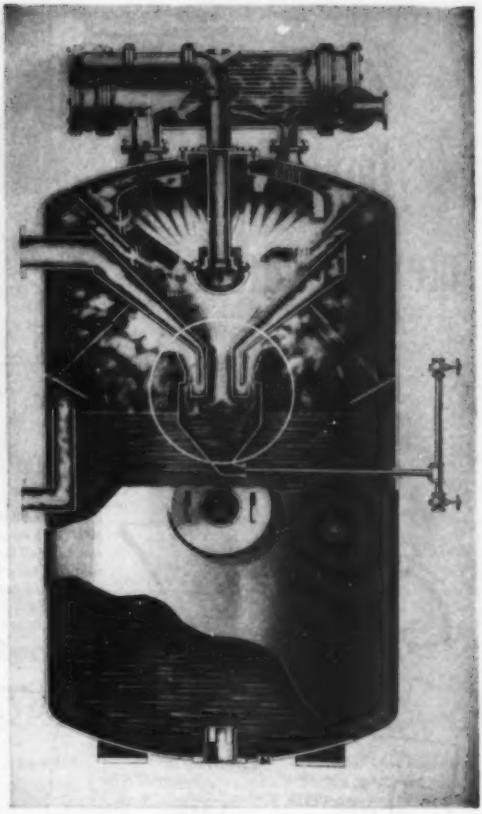


LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

68-119

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence



Hard scale, formed on the trays of deaerating evaporator preheaters, is no longer the big problem it used to be.

In a large central station (name on request), the preheaters had to be cleaned every three weeks, and the units were completely shut down at that time from eight to ten hours.

Then Worthington steam-jet deaerators were installed—with a "blowdown" head designed by Worthington engineers. This special head allows the operator to remove harmful deposits at regular intervals *while the unit continues in service*. It also provides for simple and speedy acid cleaning of critical parts, when necessary, without even opening an access door or removing any parts from the unit.

Compare The "Time-Outs"

The Worthington unit, given a short blowdown once each shift, stays in continuous operation with maximum deaeration for periods of at least 8 months. When the acid treatment is given at the end of that period, the job is finished in under three hours.

Compare this with the former record. *Then*—8 to 10 hours outage every three weeks and labor by a *crew* of men. Now—with Worthington's blowdown head—operation uninterrupted during regular short blowdown, with a shutdown for acid cleaning only once in almost a year, requiring only one man and three hours!

Worthington Makes Deaerating Equipment News

Developments like this, applicable to any deaerators operating under conditions of scaling, are typical of Worthington's engineering firsts in water treating and deaerating equipment.

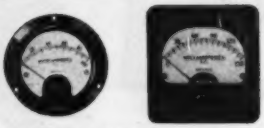
Worthington manufactures all of the equipment needed in a complete water treating installation. For further information on why *there's more worth in Worthington*, address Worthington Pump and Machinery Corporation, Steam Power Div., Harrison, N. J.

WORTHINGTON

To do important measurement jobs *Better... Quicker!*

Model 697 **VOLT-OHM-MILLIAMMETER** One of a line of pocket-size meters. Model 697 combines a selection of a-c and d-c voltage, d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

Model 686 **ELECTRONIC TUBE ANALYZER** tests tubes under exact operating potentials. Accurately determines true mutual conductance of all tubes, in accordance with manufacturers' rated operating conditions, or under desired operating conditions.



PANEL and SWITCHBOARD INSTRUMENTS—a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

Model 622 **ULTRA-SENSITIVE INSTRUMENTS**—portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

The same *dependability* evident in all **WESTON** standard instruments also is available in a broad line of *specialized* and *multi-purpose* instruments...all designed to do special and complex measurement jobs better, quicker, more economically. Whether for laboratory, shop or field requirements, first check instrument needs with **WESTON**. Consult the nearest representative, or write direct.

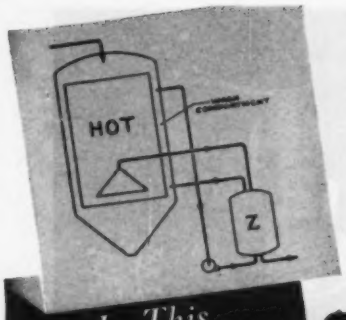
WESTON *Instruments*

WESTON Electrical Instrument Corporation
605 Frelinghuysen Avenue, Newark 5, New Jersey
Manufacturers of Weston and TAGliabue Instruments

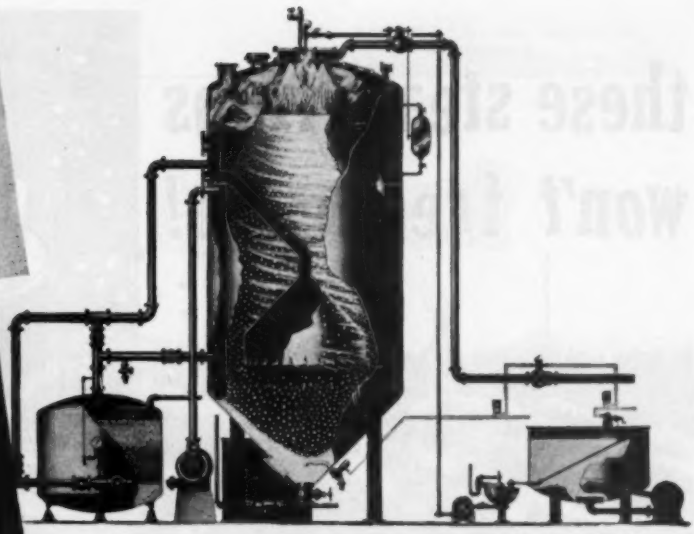
SENSITIVE RELAYS—a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

Model 901 **PORTABLE TEST INSTRUMENTS** available in d-c, Model 901—and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

Model 1411 **INDUCTRONIC D-C AMPLIFIER**—stable amplifier provides high degree of resolution even at fractional loads. Reaches steady full scale deflection in fraction of a second. Interchangeable plug-in range standards for either microamperes or millivolts.



In This **WORTHINGTON HOT-Z** *Deaerating Type Water Conditioning System . . .*



Built-In Annular Wash Water Compartment Supplies and Reclaims Backwash Water

Independent of the Softening Process

No other Hot Zeolite System offers you so many advantages as this Worthington Hot-Z System. A quick review of the vital facts will show you why.

As you probably know, Hot Zeolite beds require periodic expansion to minimize packing and friction loss, and to insure efficient contact of each Zeolite particle with its share of dissolved impurities. This need for bed expansion occurs not only during the regeneration routine, but also several times during the period between regeneration routines. That's why it is important for you to use clean, softened water, preferably at normal operating temperature, for the reverse flow or "backwash" operation.

Worthington does it!

The Worthington Standard Hot-Z System with its backwash feature provides a built-in annular wash water compartment that supplies and reclaims backwash water . . independent of the system's softening process. In this compartment, backwash water is cleaned and maintained at normal operating temperature.

This backwash feature pays off particularly in systems employing filters because it *makes filter beds last as long as eight years.*

Other advantages

Worthington Hot Process Systems come equipped with modern, direct contact vent condensers. This means, no more of the scaling trouble that made the old-fashioned shell and tube types such a nuisance.

In addition, Worthington Hot-Z Systems operate on low-priced lime and salt. That's why the average installation saves enough in chemical costs to pay for itself in 3 years.

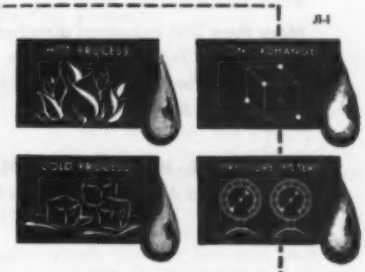
Get all the facts!

It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find in our Hot-Z System, as in so much other equipment, *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Section, Dunellen, N. J.*

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



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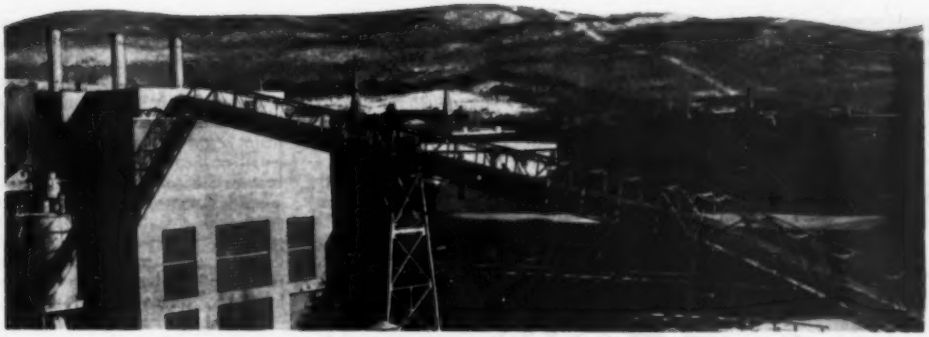
INDUSTRIAL POWER

November, 1951 Vol. 61, No. 5

SPRAGUE ELECTRIC MEETS STEAM DEMAND OF TWO PLANTS WITH A CENTRAL UNIT



Coal and ash handling systems are completely automatic at this modern steam generating power plant

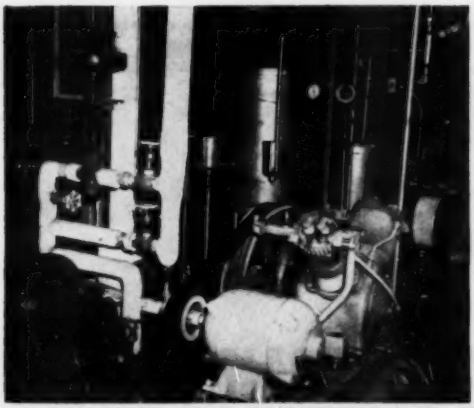
Centrally located steam generating unit, consisting of three 25,000 lb per hr capacity boilers, supplanted obsolete steam equipment in two plants approximately one half mile apart. Boilers are installed as separate units to handle varying load of 20,000 to 60,000 lb per hr

HUGH W. KIRKPATRICK, *Mechanical Engineer*
Sprague Electric Company

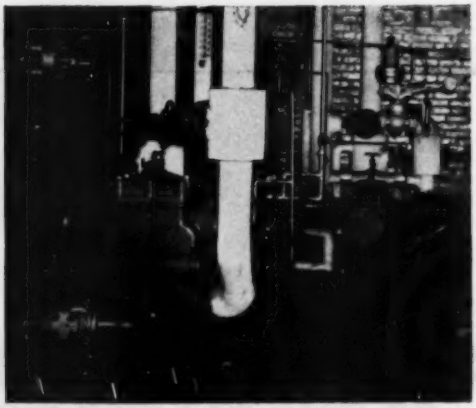
WHEN the Sprague Electric Co., a leading capacitor manufacturer, bought the buildings that formerly housed the Arnold Print Works in North Adams, Mass., it became evident that something would have to be done about the existing steam plant. This plant consisted of hand-fired HRT boilers ranging in age from 30 to 45 yr. Another Sprague manufacturing plant, which is located about a half-mile down stream had a steam plant similar to the one just mentioned. It was decided that one steam generating unit should supply both mills; so a 6 in. 250 psi steam line and a 2 in. condensate return line were constructed to connect them.

Since the steam demand varied with seasons in the range from 20,000 to 60,000 lb per hr, 3 boilers of 25,000 lb per hr capacity were installed. This arrangement allowed for efficient operation at all loads that would be encountered, as well as for any increase in steam demand in the future. The new building was erected high on a river bank so that all plant equipment would be above the highest recorded flood level. This brick and glass brick structure follows the modern trend of power house architecture.

Three spreader stoker fired, integral furnace, boilers stand side by side on the main floor. Two steam-atomized oil burners were installed in one side of each boiler so that waste process oils, collected from the mills, could be used as a supplementary fuel. Each boiler has its own turbine driven induced draft and forced draft fans, flyash reinjection blower, double cyclone flyash separator and steel stack. All 3 boilers tie into the steam main with



Auxiliary diesel generating unit can supply electrical power to operate the air compressor, stoker, conveyer and scale

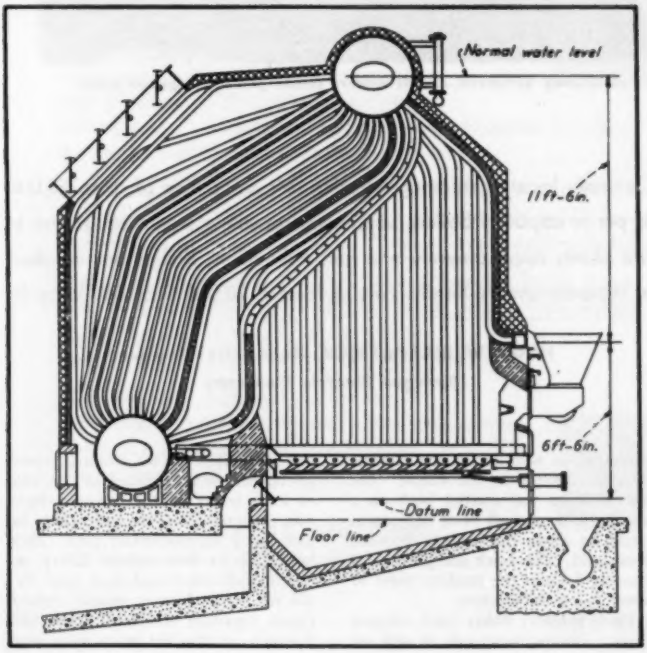


Dual-drive feedwater pump, in rear, is equipped with automatic steam valve to start turbine in case of power outage

identical piping and all the above mentioned auxiliaries are piped accordingly.

Four steam mains run parallel to one another behind the boilers; one is the 8 in. 225 psi main header that feeds both manufacturing plants, the second is a 4 in. 225 psi house line that connects to the main 8 in. line and feeds all the turbine driven auxiliaries; the third is a 2 in. 100 psi house line that connects to the 225 psi house line thru a pressure reducing valve and feeds the steam dump-grate mechanism, as well as the standby steam line running to the deaerating heater; the fourth is a 6 in., 15 psi exhaust header that feeds the deaerating heater.

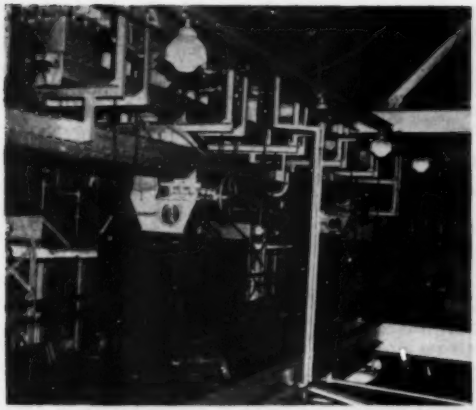
A suspension type coal bunker of 900 ton capacity is hung above the firing aisle and supplies the stokers by gravity. There are 9 equidistant openings in the bottom of the bunker for coal withdrawal. Coal from these small screws may be fed directly to the stoker below it or the coal may be fed to a main screw conveyer that runs the length of the firing aisle. An automatic coal scale is furnished for each stoker. The long screw can supply all 3 coal scales with coal. Hence, it is possible to feed each stoker from one bunker exit directly, or any stoker can be supplied with coal from any of the 9 bunker exits by means of the lateral connecting screws.



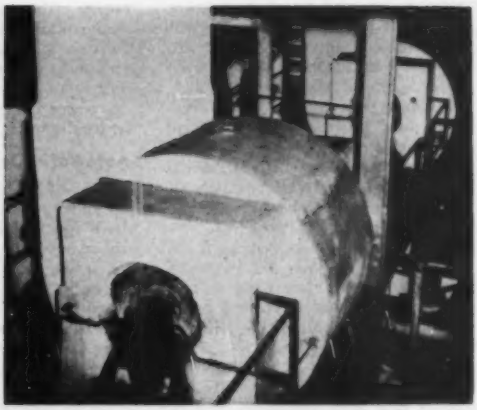
Three identical integral-furnace type boilers were installed at the Sprague plant. Basic firing is with spreader stoker, but oil burners were installed to utilize waste process oil, collected in the mill, as supplementary fuel

Improved Coal Handling

New coal handling equipment eliminates nearly all manual labor. Coal is dropped from railroad hopper cars into a pit. It is then picked up by a bucket conveyer and dropped thru a ring type coal crusher. The crusher is used chiefly to process run-of-the-mine coal to make it suitable for use with the spreader stokers. Therefore, whenever properly sized coal is purchased, the crusher is usually by-passed. Coal leaving the crusher may be sent either directly to the boiler room bunker on a 500 ft belt conveyor, or it may be delivered to a coal storage yard by means of an elevator. A bulldozer is used to make a densely packed stock pile from the coal as it falls from the elevator



Coal from overhead 900 ton capacity bunker flows through screw conveyer to scales before dropping into stoker hopper



Induced draft fans are well insulated, and air volumes are controlled by means of air operated valves limiting steam

chutes. The bulldozer is again used to move coal from the stockpile to a pit which, in turn, empties on the 500 ft conveyer belt. A drag type conveyer, located above the bunker, distributes coal along the length of the bunker.

Boiler Water Supply

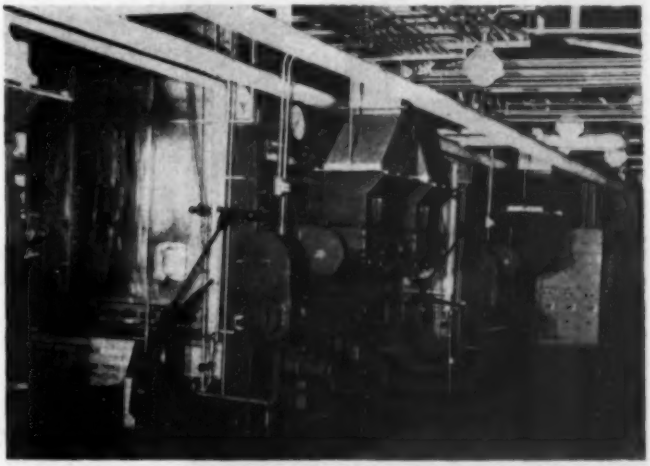
The new boiler plant is provided with 2 sources of raw water; one is city water, which arrives at 90 psi, the other is water from a private reservoir that arrives by gravity at approximately 15 psi. Since the low pressure water is subject to pressure variations due to a fluctuating demand within the mill, a booster pump was installed in the boiler room to increase the pressure to 60 psi. All raw water passes thru a double unit Zeolite water softener and the continuous blowdown heat exchanger before it enters the condensate tank. The low pressure water is normally used as make-up because it is much softer and cheaper than city water. City water automatically is turned on whenever the low pressure supply drops below 40 psi. Likewise, it is automatically turned off as soon as the pressure rises above 50 psi. The softener units are capable of treating 100 per cent make-up at maximum plant capacity. However, only 50 per cent make-up water is needed at the present time. By the time that the present expansion program is carried out at the Sprague Electric Co., the make-up requirements should be reduced to approximately 20 per cent. No further chemical treatment of feedwater has been undertaken. The internal boiler surfaces are still clean after one year of operation.

Feedwater is pumped from a 600 gal condensate tank, which is elevated slightly from the main floor, to the deaerating heater, located 20 ft directly above it, by one of 2 transfer pumps. One of these pumps is turbine driven, the other is motor driven. Proper water levels are maintained in the condensate tank and heater by means of float operated valves. The heater is equipped with an additional float operated valve, which admits raw city water whenever the water level in the heater gets too low. A stocking-type filter was installed in the feedwater line between the transfer pumps and the deaerating heater to prevent oily sludge and fine scale from entering the heater.

Three feedwater pumps are located on the main floor; namely, a dual drive 4-stage centrifugal pump, an identical motor driven pump and a duplex steam pump. Either of the centrifugal pumps is capable of providing the plant with feedwater at maximum load.

Summer Heat Balance

The duplex pump is provided with piston valves and special steam cylinder liners to permit operation with oil-free steam. This pump can supply only one boiler at a time under rated load since it was installed, chiefly, as a heat balance variable for summer loads. Normally, the motor driven pump is held as a standby and the dual drive



Each boiler has a divided ashpit and is fired by two spreader stokers, one of which can be shut down and one half of the grate dumped while boiler is on line

pump is operated by electric power, because its turbine is equipped with an automatic steam valve, which starts the turbine in case of an electric power outage. An automatic pressure regulating valve was installed in the feedwater line between the centrifugal pumps and boiler feedwater regulating valves so that a 40 psi differential exists across the valves regardless of the boiler pressure. The duplex pump has a pump governor of its own.

Any and all the components of the feedwater system may be by-passed quickly from the main floor in case of emergency. In order to further guard against loss of feedwater, each boiler is equipped with an injector. Each injector is provided with steam from the tube blower line and discharges directly into the distribution pipe of the boiler it protects. The injectors are piped to feed both treated and untreated water from both of the plant's water supplies.

Electrical Power

All electric power comes into the plant on 3 phase, 550 v lines; 110 v power for lighting and alarms is transformed within the building. All motors are protected by overload and low voltage actuated circuit breakers. A standby 62.5 kva diesel generator was installed on the main floor to furnish power for the air compressor, lights, coal conveyers and scales, stokers, flyash reinjection blowers, and small pumps in case of an electric power outage (the main feedwater pump automatically switches to steam turbine drive in such an event). This diesel unit starts and goes on the line automatically within 3 sec after an electrical power outage. However, it must be shut down manually.

Automatic Control

Combustion control was installed in this plant. The forced and induced draft fan turbines are throttle controlled by means of air operated valves. Boiler dampers and stokers are controlled by air jacks. The control panel supports hand-automatic controls for each of the above regulated components, as well as recorders for air flow, steam flow and flue gas temperature for the boilers. Also, mounted on the panel are remote water level indicators for the levels in the boilers and the deaerating heater; pressure gages for steam, water and air; draft gages, a clock and switches actuating coal screws and the ash removal system. Compressed air for operating the automatic boiler controls is normally obtained from the manufacturing plant. However, if the pressure of this supply drops below 40 psi, the auxiliary compressor in the boiler room starts automatically. This compressor stops as soon as the mill's air pressure is restored to its normal value of 90 psi.

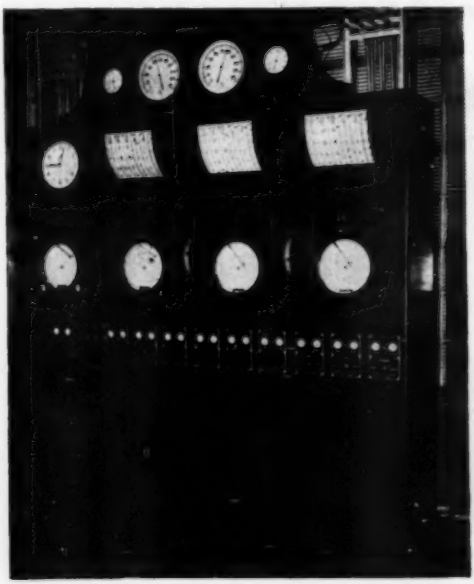
Divided Ashpit and Stoker

Each boiler has a divided ashpit and is fired by 2 spreader stokers so that one stoker can be shut down and one-half the grates dumped while the other stoker maintains steam generation at the required rate. Ash is removed from the pits by means of a steam jet operated, dry vacuum system, which delivers the ash to an elevated silo located outside the building. Dust, which is carried along with the air exhausted from the ash removal system, is removed by an air washer. The ash itself is sprayed with water when it is withdrawn from the silo. The convenience with which ash is removed and loaded into trucks maintains a steady demand for the ash as fill and driveway surface material. Rarely does the company have to pay for trucking it away.

Removal of Flyash

Flyash is effectively removed from the boiler exit gases by means of the cyclone separators and is collected in a hopper. The flyash is then taken from the hopper and blown back into the furnace. The same blower that is used to reinject the flyash furnishes air for air jets, which keep the spaces around the bottom drum free from flyash.

Although the boilers are not equipped with air heaters or economizers, they average an overall thermal efficiency of 80 per cent. Since the new plant uses a cheaper grade of coal and needs fewer men to operate it in comparison with the old plant, it should pay for itself by the time it reaches middle age. In the meantime, a neat, dependable source of steam exists.



Compact and easily observed control panel aids the operator in holding the boilers at an efficiency of 80 per cent

PRINCIPAL EQUIPMENT IN BOILER PLANT

Boilers	The Babcock & Wilcox Co.
Spreader stokers	Detroit Stoker Co.
Forced draft fan	American Blower Corp.
Forced draft fan	Curtiss Turbine Blower Co.
Induced draft fan	Worthington Pump and Machine Corp.
Induced draft fan	Green Fuel Economizer Co.
Deaerator	Cochrane Corp.
Boiler feed pump	Warren Steam Pump Co.
Combustion control	Bailey Meter Co.
Coal conveying and scales	Beaumont Birch Co.
Ash conveying	Beaumont Birch Co.
Air compressor	Westinghouse Electric Corp.
Dust collector	Buell Engineering Co., Inc.
Continuous blowdown	Cochrane Corp.
Valves	Wm. Powell Co.
Pressure reducing valve	Spence Engineering Co.
Feedwater control	Northern Equipment Co.
Injectors	Schutte-Koerting Co.
Flow meters	Bailey Meter Co.
Diesel generator	Cummings Engine Co.
Zeolite equipment	Cochrane Corp.
Pump governors	Coppus Engineering Corp.
Flyash return blower	Buffalo Forge Co.
Flyash reinjection	Detroit Stoker Co.
Pressure gages	Manning, Maxwell & Moore, Inc.
Temperature recorders	Bailey Meter Co.
Remote water level indicators	Yarnall-Waring Co.
Consulting engineers	F. B. Sheldon & Sons

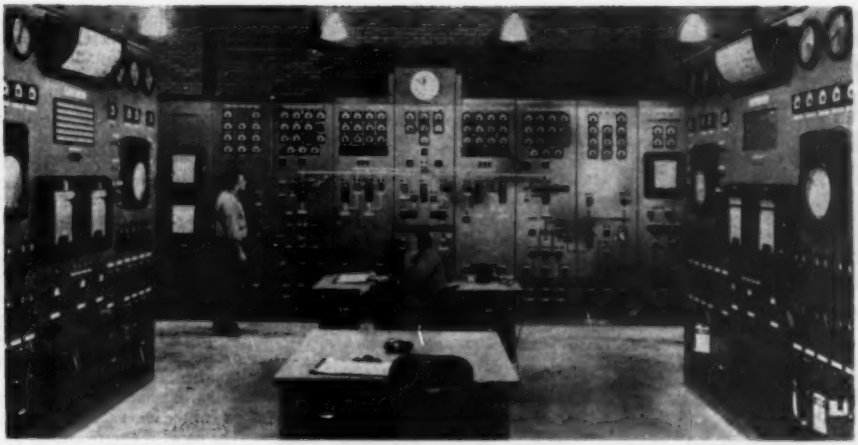


Fig. 1—Niagara Mohawk pioneered trend towards more supervisory control for fewer men

CENTRALIZED BOILER-TURBINE CONTROL

Trends are towards extensive instrumentation and automatic control but full advantages come only from central and more compact nerve centers designed to provide more information and control with minimum effort

P. S. DICKEY, *Bailey Meter Company*

OVERALL COST of generating a kilowatt hour has held reasonably constant and has, in fact, bettered its war time level in spite of increased plant and fuel costs, and increased cost per man-hour of supervision.

Improved fuel economy comes largely from higher steam pressure and temperature, the reheat cycle, improved main unit and auxiliary design and, to a certain extent, through use of units of greater capacity. Reduced cost of operating supervision has been achieved through larger units, plant design involving single boiler—single turbine units, and by regrouping personnel.

Higher ratings on major units and auxiliaries, and increased steam pressure and temperature require better and more complete instrumentation and automatic control systems for safe and efficient operation. In particular, as temperatures are increased supervisory control must be improved as the allowable limits are narrowed. Operation below design conditions reduces capacity and economy to a marked degree. Since materials are being worked close to the limits of strength and durability, operation above the design temperatures cannot be tolerated.

Supervisory Control Stations

Much progress has been made in the design of centralized supervisory control stations for directing the operation of the larger steam generating units. A study of existing plants should assist in developing improved arrangements.

Fig. 2 shows improvement of operator utilization in the American Gas & Electric Company over the past 14 years. Old Windsor Station, built in 1935, had a total capacity of 180,000 kw with six turbo generators and 24 boilers. A total of 26 men per shift was required for proper operation, giving an output of approximately 7 megawatts per man-hour per shift.

Material improvements in utilization

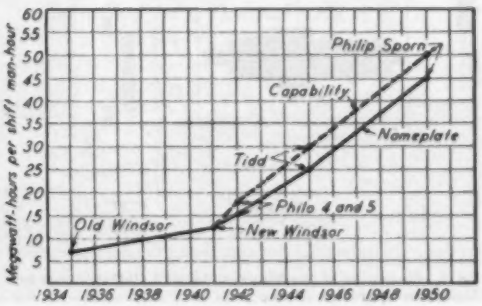


Fig. 2—Rapid increase in output of electrical energy per man-hour in the last decade is the result of designing more indications and control points into the space that can be supervised by each man. Scales must be grouped for readability and importance of function to operation

Abstracted from the ASME paper, "Modern Methods and Equipment for Control of Steam Generators."

Fig. 3—Panel at Philip Sporn station has 360 points of measurement and control

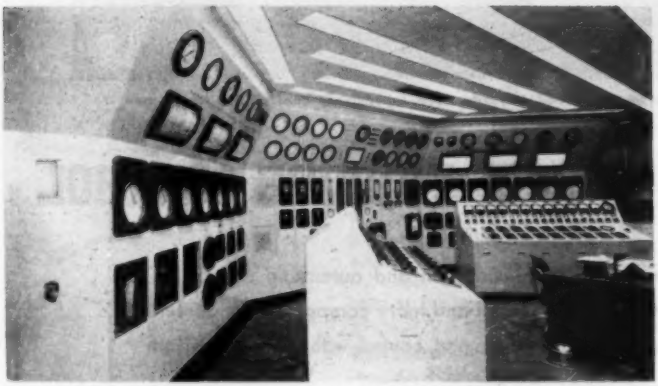


Fig. 4—Benchboards reduce length at an Oklahoma Gas & Electric plant

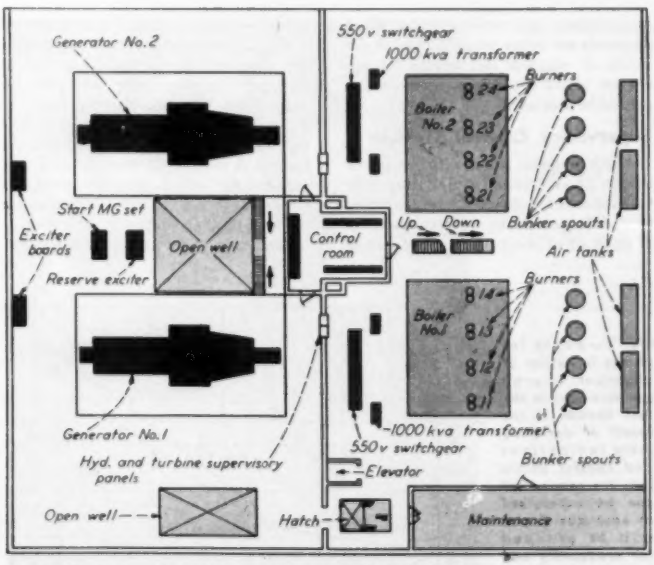


Fig. 5—Floor plan of the Niagara Mohawk station shows how central control room facilitates operation of two units with efficient use of the supervisory personnel

of operating personnel were made at Tidd Station where a centralized control room was installed and all control and supervisory functions for boilers and auxiliaries and the turbo-generator units centralized in one location. At Philip Sporn Station, the most recent plant to go in service for this company, single boiler—single turbine units utilizing the reheat cycle are used. Each unit is capable of generating 150,000 kw and operates at 2000 psi and 1050 F. With the centralized supervisory control station, the two units are operated by a shift supervisor, two control room operators and three auxiliary operators, giving a figure of 50 megawatts per man-hour per shift for operator utilization in the station.

Fig. 3 shows the control panel for one of the units at Philip Sporn Station. The panel is approximately 76 ft long. For guidance of the operator, there are more than 100 recorded measurements. 41 pneumatic control stations and more than 150 electric control stations are required. The control operator thus has supervision of more than 360 points for measurement and control of plant conditions. The panels are arranged in a semicircle around one half the control room with the control panel for the second unit on the opposite side. The watch engineer's station is adjacent to the control room.

Briefly, centralization requires attention to the following control application principles:

1. That all routine matters be delegated to continuous automatic control equipment.

2. That remote operation be provided for many functions. Certainly for all that will be required during transient conditions of the plant.

3. That controls be arranged to minimize possible errors of operation, particularly during periods of stress.

Fig. 5 shows the operating floor plan arrangement for one of the early single boiler — single turbine installations at the Niagara Mohawk Power Co. where a centralized supervisory control station was installed for operation of the units. This arrangement, with the control room located centrally between the boilers and turbines of two generating units, was developed more than ten years ago and has become a fairly common pattern in the larger steam generating plants.

In the control room, shown in Fig. 1, the mechanical boards, or those required for operation of the boiler and turbines and corresponding auxiliaries, are along each side of the control room. The electrical switchboard is at one end. Glass doors at either side provide visibility of the turbines, and windows and doors at the opposite end of the

control room provide visibility of the boilers.

In a new station at Dunkirk, similar centralized control will be incorporated. To limit length of the supervisory control panels, instruments for indicating and recording plant conditions were graded in accordance with value to the operators. Those of secondary importance to continuity of operation were placed in the rear of the cubicles. By so doing, overall length of the mechanical boards was kept to 21 ft and the most important operating information such as drum level, steam temperatures, and steam and water flow were retained as records ideally placed for observation by the supervisors.

Future Control Room Design

These examples, as well as the several others studied, indicate that complete supervision of the larger boiler and turbine units will require 300 or more points of measurement and control per unit and lead to the following general conclusions regarding arrangement of the centralized supervisory control station:

1. A common control station for two large boiler and turbine units has advantages of central location, minimum piping and wiring and good utilization of supervisory man power.

2. Control panels should be compacted to minimize distance covered by the supervising operator.

3. A functional arrangement of instruments and controls provides greater operator efficiency and minimizes operating errors.

4. Audible and visible annunciator systems should be provided for abnormalities and should preferably be grouped with indicating instruments.

5. The control station should be arranged for good visibility of the boilers and turbines from the operator's supervisory station.

6. Principal indicators and controls should be placed nearest the operator's station for maximum accessibility in case of emergencies.

A new class of miniature instruments and controls is becoming available for use in control rooms for large steam generating units, and seem admirably suited to a centralized supervisory station in designed accordance with the above specifications. Six measurements may be indicated in a panel space only slightly larger than that required for the conventional 4½ in. round dial electric instrument. Any combination from one to ten or more compartments may be provided in a single combination gage so that related information regarding major units or auxiliaries may be combined in gage groups for easy interpretation.

By properly grouping gages, and by proper arrangement of scale ranges, a pointer pattern can be developed so that under normal operating conditions, all pointers are in line, or form an easily interpreted pattern. Thus the operator reads all instruments in a gage simultaneously instead of attempting to read each individual gage separately.

A further development provides annunciator signals in the gage group. When an audible alarm is sounded indicating abnormality, the lighted target on the corresponding gage draws the operator's attention to the exact nature of the fault and minimizes the steps necessary for correction of the fault.

Fig. 7 shows a possible arrangement utilizing miniature instruments. The enclosed area need be no larger than 15 x 30 ft. This arrangement might be utilized for two small boiler-turbine units with the control console and vertical recording instrument board to the left of the operator for one unit and control stations to the right for the second unit. It could also be used for a large complex unit where both consoles and the entire recording board would be required for one unit, with a similar station on the opposite side of the control room for the second unit.

Panel space has been provided for 100 continuous records, and for more than 150 indications, 50 pneumatic control stations and 100 electric control stations. The vertical panel is 15 ft long and bench boards 9 ft.

A centralized supervisor's station gives principal indications and controls for loading, regulating and tripping major units. With this arrangement, the operator should be able to care for all normal operating and some emergency functions without leaving his post. He will also have a minimum of distance to travel when starting or stopping equipment. Ample room is provided for a second operator in case assistance is required during emergencies.

Electrical and mechanical connections may be taken out through the bottom of the control panels. Walk-ways beneath the floor simplify connections and maintenance of equipment on the bench board.

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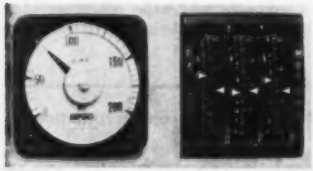


Fig. 6—Trend to smaller instruments is shown above by long scale, 4½ in. ammeter and the six point pneumatic indicator with same space requirements

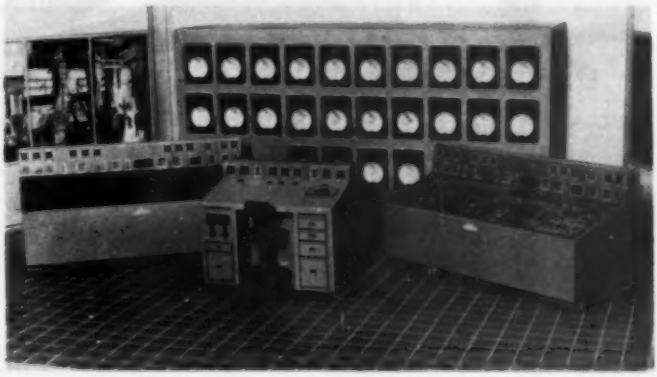
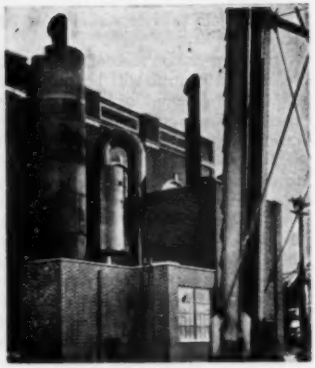


Fig. 7—Model of a control room at right is designed for smaller generating units. Small instruments conserve space. Windows overlook boiler and turbine operating floors on each side

PEAK DIESEL EFFICIENCY AT ROCKVILLE CENTRE

To promote diesel efficiency at the Rockville Centre municipal power plant engineers have set up a complete preventive maintenance program, and prime movers are kept at peak levels at all times. One diesel engine in 1933 produced 12.5 kwh per gal of fuel—today it is 13.05 kwh

C. P. KETLER, Commissioner of Public Works, Rockville Centre, Long Island, N. Y.



Air for the new 3850 hp diesel is drawn through an intake silencer and filter. Exhaust gases pass through a silencer

ROCKVILLE CENTRE municipal power plant long has been notable for the efficiency of its diesel operation. But new engines are only half the story. Engineers, at this plant, obtain the best performance from their older prime movers, maintaining and even improving their efficiency down through the years. For example, a 2865 hp diesel installed in 1933 generated 2,287,600 kwh in its first full year of operation at an average of 12.5 kwh per gal of fuel. In 1950-51, the same engine produced 7,529,200 kwh for an average of 13.05 kwh per gal.

However, with the increased use of electricity loads have been pushed skyward. The plant could no longer carry the peak without its biggest engine. In fact, the load came very near actual plant capacity with all engines in operation. Obviously plant expansion was essential and Rockville Centre officials moved quickly to secure another engine in time to help carry the December 1950 peak.

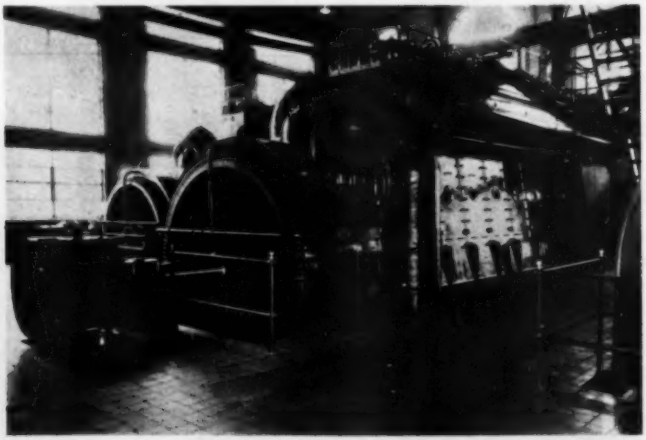
Official recommendation was a nine cylinder two-cycle, mechanical-injection diesel engine with 21-1/2 in. bore and 31 in. stroke, developing 3850 hp at a moderate 225 rpm. Like the other units in the plant, it is a cross-head type engine. In choosing this new prime mover, the village held to its long-established preference for heavy-duty, slow-speed engines.

Fuel economy has been a crucial matter during the post-war inflationary period. Officials of the municipal utility recognized a dual responsibility: first, to keep electricity rates down; second, to continue the contributions of cash and services that serve to reduce village taxes.

This responsibility has been accomplished because Rockville Centre engineers have been able to obtain more power per gallon of fuel and because the engines in use are capable of burning relatively low-cost oil. The village paid 5 cent a gallon in 1942 and 8-1/2 cent in 1951. Both the air-injection and the newer mechanical-injection engines burn a No. 4 fuel oil. This clean, high-grade fuel presents no special handling problems. Other than the usual duplex, bag-type pressure filter on the engine, no cleaning equipment is deemed necessary.

Handling Lube Oil

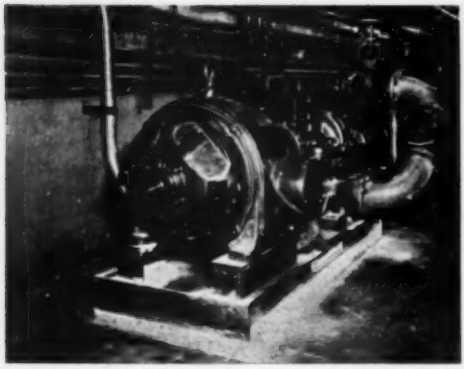
In lube oil handling, the new engine differs from the others in that there is no engine-driven pump to circulate oil for bearing lubrication and piston cooling. Instead there are two identical 360 gpm pumps driven by 25 hp motors. One pump handles the engine adequately while the other serves as a standby and is arranged to start auto-



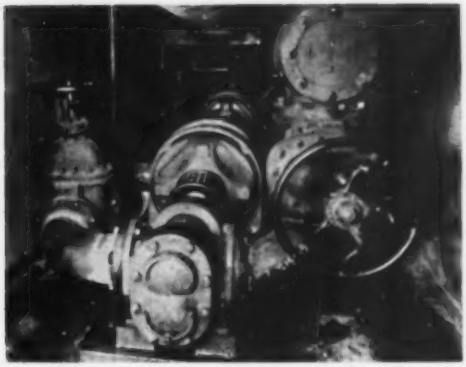
This 21.5 in. bore 31 in. stroke diesel was placed in operation in Dec. 1950. During early runs it produced 14.33 kwh per gal of fuel when operated at 65.6 per cent load

TABLE 1—FUEL OIL SPECIFICATIONS

Btu per lb	18,995
Conradson carbon, per cent	0.51
Ash, per cent	0.002
Sulfur, per cent	0.14
Gravity API at 60 F	21.7
Viscosity SSU a 100 F	68.5
Hard asphalt, per cent	0.09
Water & sediment, per cent	0.05
Flash point, deg F	210
Pour point, deg F	—70
Diesel index No.	27.5
Aniline point, deg F	138



Addition of the 3850 hp diesel required only the installation of this 1500 gpm centrifugal pump for engine cooling, as the existing cooling tower system was adequate



Two lube oil pumps, one acting as a standby, supply lubrication to the new unit. These pumps are arranged so the standby unit will start when the lube oil pressure is low

matically if lube oil pressure should fail. Plant engineers feel the new set-up is more dependable and easier to service.

Every precaution is taken to keep the lube oil free of contaminants that might harm the engine. The circulating pump draws oil from the sump tank and puts it through a strainer, a cooler and a magnetic filter before returning it to the engine. In addition, there is a small motor-driven pump that draws lube oil from the bottom of the sump tank, discharging it through an 18-cartridge cellulose filter and back to the sump. There is a separate mechanical lubricator for each cylinder.

Lube oil economy has been particularly good in the case of the new diesel. In the first 909 hr of operation, the engine consumed only 417 gal, an average of 8392 hp-hr per gal.

Utilize Old Standpipe

Rockville Centre's ingenious cooling tower was more than adequate to take on the added load of the new engine. This tower — an old standpipe erected back in 1895 — has sections cut in the sides to permit atmospheric cooling. Red-wood filling and distributors and a two-speed, motor-driven induced-draft fan have been installed to provide a highly flexible cooling unit with great capacity. Addition of the 3850 hp engine required only the expansion of pumping capacity, which was accomplished by installation of a 1500 gpm centrifugal pump driven by a 100 hp motor.

Scavenging Air

Air for the big two-cycle, port-scavenging engine is drawn through an intake silencer and a battery of filters of the viscous impingement type. This clean air is drawn into an engine-driven blower of 18,000 cfm capacity, then discharged through the intake header to the cylinders.

In previous installations, provision was made for utilization of heat from the exhaust. Two of the old engines were equipped with waste-heat boilers, and a 3000 hp engine exhaust silencer was enclosed in a brick housing with a motor-driven blower to send exhaust-heated air into the plant during the winter months. The heat balance of the plant was such that no further waste-heat could be utilized profitably, and so the new engine exhausts through a vertical silencer with no provision for heat recovery.

Auxiliaries

The latest diesel unit is served by a convenient gage and alarm panel, which holds a multi-point exhaust pyrometer, gages for water, lube, fuel and starting air, alarms for jacket water and lube oil pressures and temperatures, and control switches for the two lube pumps and a fuel booster pump.

To attain the long efficiency record of the plant required both good equipment and expert operation. For this reason a preventive maintenance program was designed to keep the prime movers at peak performance levels. Indicator cards are taken, and an inspection data sheet is filled out once a week for each engine. Corrective action is taken promptly if there should be any evidence of trouble. On the two-cycle engines, pistons are pulled for inspection every 3000 hr. All maintenance work is scheduled in such a manner that the engines are ready for service to help carry the peak loads.

PRINCIPAL NEW EQUIPMENT AT THE ROCKVILLE CENTRE MUNICIPAL POWER PLANT

Engine	Nordberg Mfg. Co.
Generator	Westinghouse Electric Corp.
Fuel filters	Wm. W. Nugent & Co., Inc.
Fuel injection pumps	American Bosch Corp.
Governor	Woodward Governor Co.
Lube oil pumps	H. K. Porter Co., Inc.
Lube oil strainer	Nordberg Mfg. Co.
Lube oil cooler	Ross Heater & Mfg. Co., Inc.
Magnetic filter on lube	Nordberg Mfg. Co.
Cylinder lubricators	Mansel Inc.
Lube oil filter	The Hilliard Corp.
Cooling water pump	Ingersoll Rand Co.
Cooling water pump motor	Westinghouse Electric Corp.
Intake silencer	Maxim Silencer Co.
Air filters	American Air Filter Co., Inc.
Exhaust silencer	Maxim Silencer Co.
Blower	Roots-Connersville Blower Corp.
Gage board	Nordberg Mfg. Co.
Pyrometer	Illinois Testing Laboratories, Inc.
Alarms	Viking Instruments Inc.
Gages	J. E. Lonergan Co.
Switches	Cutler-Hammer, Inc.
Thermometers	The Electric Auto-Lite Co.
Voltage regulator	General Electric Co.

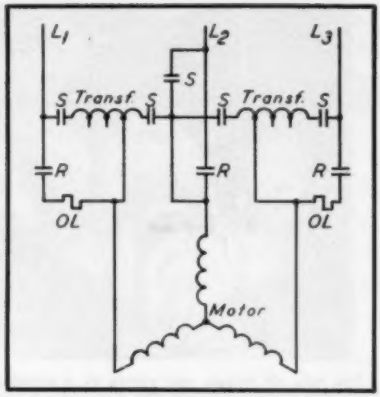


Fig. 1—Autotransformer starters are manual or automatic. Characteristics vary with tap choice

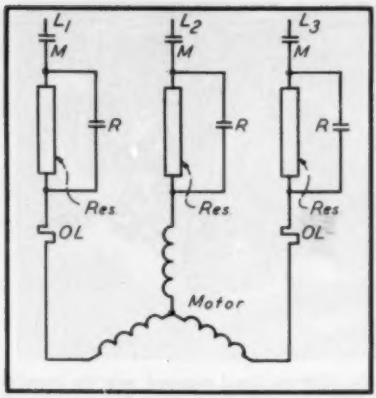


Fig. 2—Simple resistance starters have high current surges but are desirable for some jobs

STARTERS THAT CUSHION THE ELECTRICAL SYSTEM

H. L. LINDSTROM, *Control Engineering*
Westinghouse Electric Corporation

More and larger motors may need starters to reduce current surges. Here are torque and current characteristics, comparative costs and auxiliary equipment for the various types

HORSEPOWER rating of new motors is increasing and more attention must be given to the effect of the high starting currents on the power systems. Some power companies put definite limits on size of motor that can be started across the line—particularly on networks. In other cases, it is desirable to keep current peaks down to insure proper operation of other electrical equipment connected to the same plant circuits.

On power systems that have no automatic voltage regulation, there is a definite maximum current that cannot be exceeded without causing such a voltage drop that other equipment

TABULATION OF CHARACTERISTICS FOR CUSHION STARTERS

Type of motor	Type of starter	Cost index, motor plus starter	Per cent full voltage values at starting			Contactors		Number of OL relays	Auxiliary equipment	Losses in starting	Transition
			Terminal voltage	Approx. current	Starting torque	Number	Per cent size				
Squirrel cage	Manual: autotransformer	100	50 65 80	30* 48* 71*	25 42 64	1-5P	100	2	Transformer	Low	Open
Squirrel cage	Magnetic: autotransformer	121	50 65 80	30* 48* 71*	25 42 64	1-5P 1-3P	100	2	Transformer	Low	Open
Squirrel cage	Magnetic: primary resistance	119**	80	80	64	2-3P	100	2	Resistor	High	Closed
Squirrel cage	Magnetic: primary reactance	121	50 65 80	50 65 80	25 42 64	2-3P	100	2	Reactance	Medium	Closed
Squirrel cage	Star-Delta	123	...	33	33	2-3P 1-2P	100	2	...	None	Open
Squirrel cage	Part winding	105	...	60	50	2-3P	50	4	...	None	Closed
Squirrel cage	Electronic	...	...	...	...	...	...	...	...	...	Closed
Wound rotor	Drum controller	193	...	...	...	...	...	2	Resistor	High	Closed
Wound rotor	Magnetic starter	228	...	...	...	...	...	2	Resistor	High	Closed

*Applies only to transformer designed for motor used.
**Same cost as autotransformer above 40 hp, 440 v.

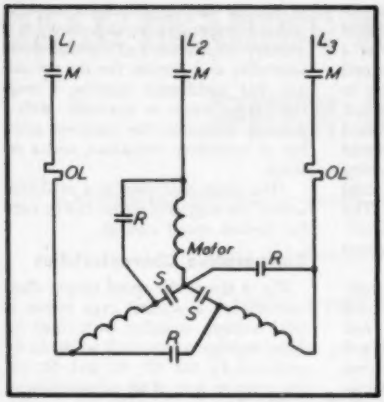


Fig. 3—Star-delta starting needs special connections, gives single, low value torque curve

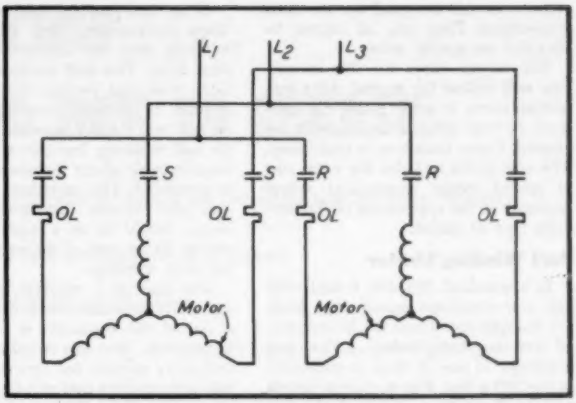


Fig. 4—Part winding starting is readily adapted to standard motors, is the cheapest automatic system, gives 50 per cent of maximum torque

may not function properly. On other systems that have automatic adjustment of voltage (such as network systems), there is a limit to the increment of current at one time. As long as the current is increased in steps far enough apart to permit correction by the regulator, then larger total currents can be accommodated.

Starters discussed herein employ the various means used to "cushion" the shock on the line by reducing the starting current of induction motors. Schemes which accomplish purely "torque" cushioning are not included in the scope of the article.

Autotransformer Starter

Referring to Fig. 1, an autotransformer is connected to the line and, during starting, the motor is connected to reduced voltage taps on it by means of a five pole, full current contactor. This contactor may be one size smaller on the larger starters.

Simplest form is the manual type in which the operator pulls the handle forward for starting, then pushes it back for running. It has the lowest cost of any of the starters, but has some disadvantages. Time of changing from start to run is left to human judgment and may result in unnecessary current peaks. Open transition is the standard arrangement. There is a loss of torque during the transfer period because one contactor must open before the other closes to prevent short circuiting of the autotransformer.

Taps usually are provided so that 80, 65 or 50 per cent of the line voltage may be obtained. This results in starting torques of 64, 43 or 25 per cent of full voltage torque. The selected percentage prevails during acceleration, giving a torque curve proportional to the original motor curve. Losses during starting are low, and therefore line currents are low, provided the transformer is designed for the size of the associated motor.

Another form of this starter uses magnetic contactors, usually with time delay between the two steps. Automatic acceleration thus may be obtained with comparative simplicity. The magnetic form also lends itself to several variations, among which are methods of obtaining closed transition by the use of additional contactors in the starter circuit.

A cost index including totally enclosed, fan cooled motors and each type of starter is given in the table. This index is an average of three typical motor sizes (25 hp, 100 hp, and 200 hp) for both 220 and 440 v. It is interesting that, in compiling the table, deviation from average was small for any one type of starter. The index is based on 100, assigned to the manual type autotransformer starter. The simple magnetic autotransformer starter comparative cost is 121.

Primary Resistance Starter

In this type, shown in Fig. 2, a resistor is connected in series with each phase, producing a reduced voltage at the motor terminals due to the IR drop of the starting current. When the motor has had time to accelerate, a time delay relay and contactor short out the resistors.

This starter is simple, since only two 3-pole contactors, a timing relay and the resistor are required. It also has inherent "closed transition," as the resistor is shorted out and the line is not opened. Starting power factor is high.

It has the disadvantage of requiring higher line current for the same available starting torque than the autotransformer, and power losses are higher. However, as motor speed increases, the current drops, which in turn increases the motor voltage and torque. This characteristic is desirable for pumps and similar machines which require increased torque as they reach full speed.

The commercial starting resistor is designed to produce 70 to 85 per cent voltage at the motor terminals, depending on the particular motor design. The cost index is 119, due to lower prices in the lower horsepower ranges of the combination.

Primary Reactor Starter

The primary reactor starter is almost identical to the resistor type, except for the substitution of reactors. A reactor, however, lends itself better to high voltage and is used on most high voltage designs.

Losses during starting are lower than for the resistor type, which makes it desirable for the large size motors. Starting power factor is lower. Cost index is the same as for the magnetic autotransformer type.

Star-Delta Starter

This type, used with a motor whose windings are delta connected for running, connects the windings in star for starting, Fig. 3. Voltage across each winding is reduced in the ratio of 1/1.732, and line current is reduced to one third that of the delta connection. A fixed torque of approximately one-third normal is obtained.

Two 3-pole and one 2-pole contactors, each full size, are required but there is no transformer, resistor or reactor, and therefore no extra losses.

This starter lends itself well to motors of standard European connections such as 220/380 v motors, but standard dual voltage motors in this

country are not designed for star-delta connections. They can, of course, be obtained on special order.

The torque curve for star connection will follow the normal delta connection curve in general shape at one-third normal value, and cannot be increased. Open transition is mandatory. The cost index includes the extra cost of special motor connections where necessary in the application of the star-delta type of starter.

Part Winding Starter

In a standard 220/440 v dual voltage, star connected motor, nine leads are brought out. These can be connected into two independent 220 v star windings. If one of these is connected to the 220 v line, Fig. 4, current inrush will be about 60 per cent of the full winding inrush—and produce approximately 50 per cent of the full winding starting torque. If the friction load and inertia are light enough, the motor will accelerate to nearly full speed with another, but greatly reduced, current peak when the second winding is connected to the line.

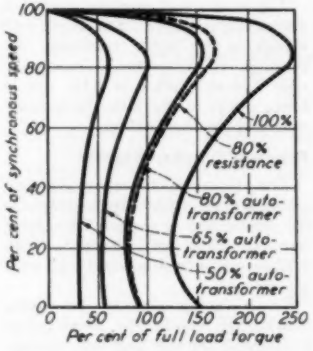


Fig. 5—Curves show torque characteristics for the squirrel cage starters

If the load prevents rotation, or prolongs acceleration, then the second winding must be connected after a time delay. This will produce a second large peak and increase the torque to normal. If the motor has not started, current will be the same as if started on full winding, but this still should be acceptable where increment starting is permitted. The contactors are rated one half normal horsepower. The torque would be on a curve approximately 50 per cent of the normal curve for both windings.

The leads of a standard, dual voltage, delta connected motor can be used if one of the contactors is rated full horsepower, but this winding is not ordinarily suitable for connecting into two independent part windings. However, six leads for part windings easily can be brought out if requested on the order. Single voltage motors and motors for 440 and 550 v service must be ordered specially for part winding starting.

The two parts of the winding usually are in a 1/1 ratio, but other ratios can be used, depending on how the particular motor coils can be connected. Other schemes, such as single-phasing steps and resistors, are possible but increase the cost. Closed transition is inherent.

The cost index of 105, includes motor modifications where required.

Electronic Starter

The starter in Fig. 6 uses electronic tubes (electronic contactors) with phase-shift control. This reduces the average voltage, current and torque. Starting torque is readily adjustable, but at a high price if tubes are not otherwise justified.

Wound Rotor Starter

The wound rotor motor and starter illustrated in Fig. 7 are both basically more expensive than the squirrel cage components. However, the system gives maximum starting torque per ampere.

Least expensive arrangement is a primary linestarter and manual drum controller and resistor for the secondary. For pushbutton starting, a magnetic type starter is available with a primary contactor, the required number of secondary contactors, and a resistor.

The drum controller or a modification of the magnetic starter can be used for limited speed control.

Comparative Characteristics

Fig. 5 shows the speed torque characteristic of a squirrel cage motor at rated voltage, together with three reduced voltage curves such as would be produced by the 80, 65 and 50 per cent voltage taps of an autotransformer. The dotted curve is the torque with a primary resistor or reactor starter producing 80 per cent voltage at starting. The star-delta and part winding curves will fall essentially parallel to those of the autotransformer starter, but at 33 per cent and 50 per cent of the full voltage torque values.

Conclusions

Of the types discussed, the manual autotransformer has the lowest initial cost. The part winding starter is the lowest cost magnetic starter, and very useful where starting torques of the load are under 50 per cent of the full winding torque—or where increment starting is permissible.

Where starting torques must be higher, and where currents are allowed to be higher, the primary resistor or the autotransformer are needed. The primary resistor starter is more suitable to loads starting at low values and building up as the speed increases.

For the best in torque per ampere of starting current, the wound rotor still is at the top, but also has the highest cost. Therefore, it is seldom used except where the last ounce of torque or where speed control is needed.

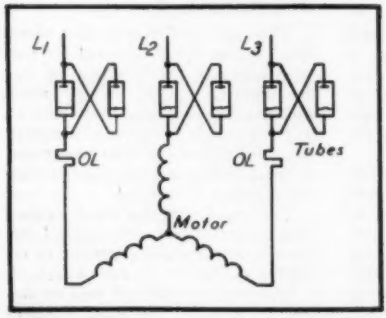


Fig. 6—Electronic starters provide a readily adjustable torque by phase shift, are expensive

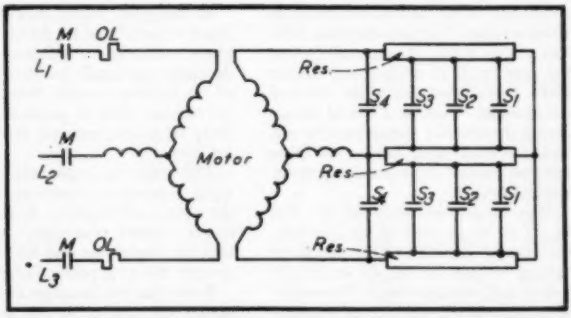


Fig. 7—Costly, wound rotor starting systems may be justified where high starting torque and/or speed control are required on equipment

BALL BEARING MOTORS . . . .

WHEN AND HOW TO GREASE

Lubrication schedules for electric motors should be based on consideration of these factors:

- **Life of lubricant varies with bearing size and speed.**
- **Type of grease depends on application.**
- **Economics of greasing, or running bearing to failure on original lubricant.**
- **Provisions for lubrication made in design of the bearing housing.**
- **Recommended procedures in adding or replacing lubricant.**

LUBRICATION technique is essential to proper maintenance of the many types and sizes of electric motors used in modern industry. No machinery can be expected to run without lubrication. For most efficient operation and the longest life from electric motors, it is usually recommended that the lubricant be replenished or renewed at regular intervals.

The essential ingredient of all lubricating agents is oil, either in its free state or suspended in a compound, as in the case of grease. Various lubricating devices are used to deliver the oil to the moving parts. The devices listed in the box apply in variable extent to both sleeve and the antifriction bearing types.

Grease lubrication is used for most applications of ball bearings in electric motors because it provides simplicity of bearing housing, minimum space requirement, minimum loss of lubricant, and ease of relubrication when required.

Much progress has been made through modern research in developing improved greases for motor lubrication. A good grease will: (a) lubricate balls and races, reducing wear from sliding friction, (b) lubricate cages or retainers, reducing wear from rubbing action, (c) prevent corrosion of bearing surfaces and (d) prevent escape of lubricant from the housing.

COMMON LUBRICATING DEVICES ON ELECTRIC MOTORS

1. **A simple hole leading to the revolving member. Satisfactory only if the apparatus is used intermittently, or if lubricant is added frequently or continuously.**
2. **Wool yarn, which lifts oil from a reservoir by capillary action. Works well on small machines operating in a horizontal position.**
3. **Oil ring, chain or similar device which delivers oil from a reservoir to the revolving member. Used on larger appartus operating in a horizontal position.**
4. **Oil pump to circulate oil from reservoir to bearing surface. Can be used for very large units, but is usually too expensive for ordinary applications.**
5. **A slinger or air jet which delivers oil to the bearing surface may be necessary for high speeds where extreme rigidity is required, as in grinding ball bearing races. Requires constant maintenance and is used as a last resort.**
6. **Grease which, as a storage reservoir for the oil, releases it to bearing surfaces. Can be applied in a number of ways; usually as a mass contacting rolling elements. While the soap or other stiffener may have some lubricating value, the essential ingredient is oil. With the proper grease, oil is delivered to the bearing in the required amount and with minimum attention.**

Bearing Life

Life of the bearing depends on life of the lubricant, which is affected by a number of factors such as type of grease used, hours per day of operation, surface speed of the rolling member, and operating and load conditions.

Common causes of ball bearing failure are:

1. Carelessness. Dirt or other foreign matter in the bearing housing will damage rolling surfaces. Rapid wear and noisy operation will result.

2. Overloading. A motor bearing may be overloaded by excessive belt tension or improper alignment, causing flaking on bearing surfaces and cracking, as well as pitting or breaking of the balls.

3. Improper Grease. If the grease does not have proper characteristics, the oil will separate from the soap, producing a sludge which resists the rotation of the bearing. Excessive bearing temperature may result.

4. Overlubrication. If the housing contains too much grease, a churning action occurs at high bearing speeds.

Data and information for this article were obtained through the cooperation of O. Wulfort, Chief Mechanical Engineer, Electrical Division, Wagner Electric Corp.

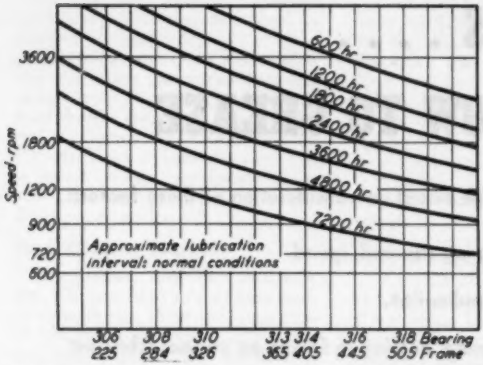


Fig. 1—Curves give the recommended lubrication intervals (operating time) for bearings of various sizes used at different speeds. Special cases may require modification

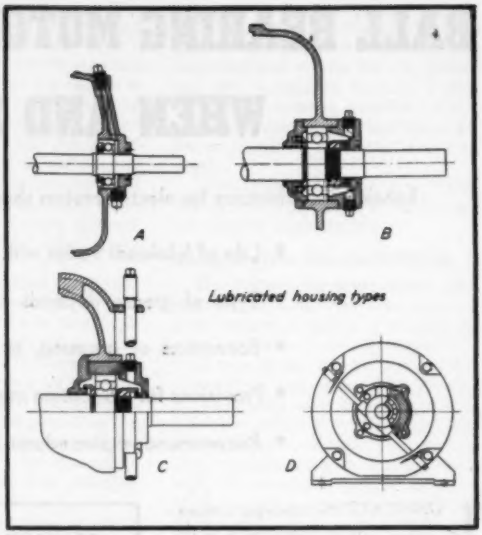


Fig. 2 (right)—Design of bearing housings and provision for lubrication vary with size and type of motors; may include features of sealed bearings as well as relubrication

TABLE 1—PROCEDURE FOR ANNUAL LUBRICATION OF BALL BEARING MOTORS

1. Blow all dirt from interior of the motor, and give exterior a thorough cleaning.
2. Remove the pipe plug from both lubrication and drain openings.
3. Run a rod or wire part way into the lubrication opening to determine if the grease is dry and hard.
4. If the grease is hard, run the motor while adding a little oil to soften the grease. Operate motor until grease starts to run from drain opening.
5. Stop the motor and add grease until the old black grease has passed out and new grease starts to come from the drain opening. Grease is added to the housing by means of a standard grease cup.
6. Operate motor and allow the bearing to force out excess grease.
7. Stop the motor and run the rod or wire into the lubrication and drain openings to force out some of the grease to allow for expansion when the motor is operating.
8. Replace both plugs.
9. Run the motor. Make report indicating whether or not the motor is considered to be in satisfactory operating condition. If not, an investigation is made by the plant electrician.

Results are similar to those caused by improper grease.

5. Lack of lubrication. This, of course, is fatal. Wear and corrosion quickly ruin the bearing completely.

Fig. 1 shows approximate lubrication intervals recommended for ball bearing electric motors under normal operating conditions. Under severe conditions, involving high temperatures or unusual service, the greasing interval can best be determined by experience. Practical examinations will soon indicate how long the motor will remain properly lubricated.

According to Fig. 1, size of the bearing and speed at which the motor operates are two important factors that affect bearing life unless the lubricant is renewed in time. Motors in the smaller frame sizes will often operate for the life of the unit without relubrication. In the larger frame sizes, frequent lubrication may be required, although in many cases, where service conditions are not severe, large motors have operated for years without additional lubrication.

In normal applications, it is recommended that motors be relubricated annually, unless size and speed of the motor call for a shorter interval.

Housing Construction

In Fig. 2, cross section *A* shows one type of housing used on fractional horsepower ball bearing motors. Lubricant in the original bearing is usually sufficient for a long period, but a means permits relubrication if necessary.

A two cap design of housing for open type integral horsepower ball bearing motors is shown at *B*. Two openings are provided, one for adding new lubricant and the other for draining the excess. Labyrinth seals retain the grease and prevent entrance of dirt, dust or other foreign matter. Condition of lubricant and rolling elements can be observed by removing the bearing cap. If the rotor must be removed for repairs, the two caps can be clamped together to protect the bearing against dirt and damage.

Cross section *C*, Fig. 2, is a housing for externally ventilated (totally enclosed, fan cooled) motors. The outside bearing cap can be removed to check the lubricant and rolling elements, but it is also possible to remove the rotor without exposing the bearings. As shown at *D*, another view of cross section *C*, long grease pipes are sometimes provided for convenience. Also, by passing a rod or wire completely through the pipes and housing (while the motor is not running) old grease is forced out and new grease will be deposited immediately in the path of the rolling elements.

Special Cases

There are applications where relubrication of motor may be inadvisable. In some manufacturing plants, such

as textile mills, the presence of any oil or grease may be objectionable. Ultimate bearing failure and replacement of the motor is usually preferred to the risk of having the product damaged by excess lubricant.

In locations where it is inconvenient, dangerous or even impossible to relubricate the bearings, it may be more economical to postpone any attention to the motor until bearing failure or other breakdown occurs.

Particularly dirty locations, such as coal mines, make it practically impossible to relubricate without danger of adding dirt, grit or other harmful substances along with the grease. In such cases, it is better to wait until repairs are in order before attempting to lubricate the bearings.

Many industries, because of rigid requirements for continuous operation, have definite schedules for overhauling all equipment and intermediate relubrication can usually be omitted.

Prelubricated Bearings

Sealed, prelubricated bearings can be used for many motor applications, and may be desirable in motors where definite requirements are specified. One advantage is an extremely simple bearing housing. However, the chief difficulty arises when the bearing ultimately fails, requiring major repairs. A little added grease might have prolonged the motor's life considerably.

Referring to Fig. 1, lubricant life is determined largely by the size of the bearing and the speed at which it revolves. The life of the sealed, prelubricated bearing, therefore, is definitely limited in total running time, while the life of bearings that can be relubricated may be prolonged indefinitely.

One application made a number of years ago specified fractional horsepower motors with sealed bearings for gasoline pumps. Bearing failure was caused by spilled gasoline which entered the housing. This, of course, is an exceptional case, but it illustrates the value of providing means for relubrication even though no immediate need is foreseen.

Choice of Lubricant

Type of grease is one of the most important factors contributing to long bearing life. That recommended by motor manufacturers has been thoroughly tested, and proved satisfactory during long service in practically all industries.

Unusual temperatures and other severe operating conditions may make special procedure or lubricants necessary. Whenever possible, however, in order to reduce the number of lubricants and thereby reduce possibility of error, a standard lubricant should be used. For example, it is usually preferable to apply lubricant more frequently than to stock a special grease particularly suited for high speed operation. When a special lubricant is essential, information can be obtained from the motor manufacturer or the lubrication engineer of the grease supplier.

Lubrication Procedure

Since adding grease to a bearing housing is apparently a simple matter, the natural tendency might be to consider that it can be done by anyone, without specific instructions. Haphazard maintenance, however, may result in more harm than good. Certain fundamentals, such as cleanliness and the proper type and the proper amount of grease, must be considered and the job should be done by a competent mechanic who realizes that he is responsible for the efficient operation of an expensive piece of equipment.

Lubrication procedure, of course, will vary according to the special conditions encountered in particular plants. It is difficult to make general recommendations that will apply in all cases, but the following procedure covers all essential points of a good lubrication schedule:

1. Inspect all new motors when installed, and lubricate if necessary. This is especially important in the case of sleeve bearing motors, which are usually shipped without oil.

2. Lubricate ball bearing motors once a year. Certain motors are lubricated at shorter intervals if the original consideration or the yearly inspection has indicated that additional attention is required.

3. When trouble occurs in any motor, notify the plant electrician. Investigation of the trouble and the necessary repair or replacement of the unit is done by workmen under his supervision or direction.

4. Follow instructions in Table 1 for annual lubrication of motors.

I&P EXPANDS EDITORIAL STAFF

Effective November 1st, Jack E. Hinkley joins the editorial staff of I&P. A graduate mechanical engineer, University of Wisconsin, Mr. Hinkley, for the last five years, has been a field and construction engineer for the Hoffman Combustion Engineering Corp. of Detroit.

This is a further step in I&P's editorial expansion program to provide additional service to our readers with a still more comprehensive coverage of the problems and developments in the field of Engineered Plant Services, for which I&P is published.

Mr. Hinkley has been associated with such important steam and power plant installations as Hanna Coal Co. Preparation Plant, Cadiz, Ohio; Southwestern Federated Power Cooperative (REA), Creston, Iowa; Inland Steel Co. Coal Preparation Plant, Price Mine, Wheelwright, Ky.; VA Hospital, Sheridan, Wyoming; Raton Public Service, Raton, N. M.; and Pittsburgh Plate Glass - Plant #1, Creighton, Pa. Also such jobs as International Paper Co., Ticonderoga, N. Y.; Diamond Match Co., Springfield, Mass. and Oswego, N. Y.; Tappan Stove Co., Mansfield, Ohio and Murray, Ky.; and Pet Milk Co., Bowling Green, Ky.

Previous to this, Mr. Hinkley was associated with the RMR Corp., a subsidiary of Ray-O-Vac Corp., the University of Wisconsin Pumping Station, and the Lazear Equipment Co., Columbus, Ohio. Mr. Hinkley's excellent background in the field and his widespread experience throughout industry make him a valuable addition to INDUSTRY AND POWER's editorial staff.

Jack E. Hinkley

L. G. Crist

Publisher

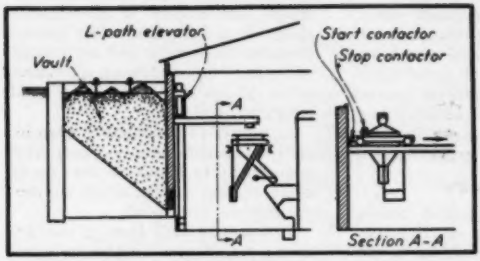


Fig. 1—Installation of this fully automatic transfer for coal from bin to weigh larry has reduced operation costs

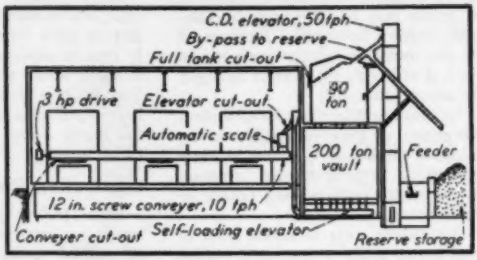
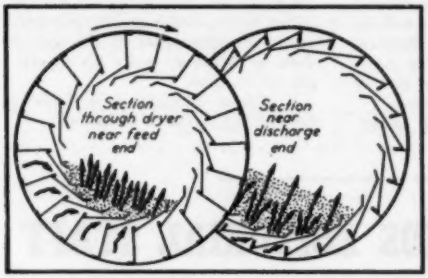


Fig. 2—Complete mechanization of coal handling system is ideal for large power plants, even though costs are high



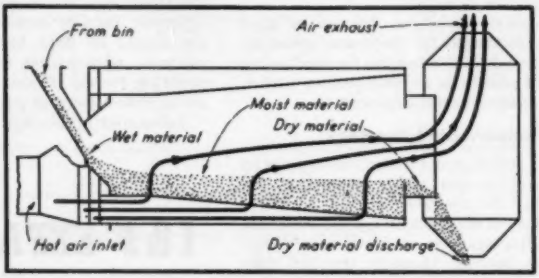


Fig. 3—Rotating dryer reduces surface moisture content of coal from approximately 12 to 4 per cent. Dry hot air is blown through the coal bed as it travels toward discharge. Coal flows readily when moisture is reduced to 6 per cent

LOGICAL APPROACH TO HANDLING COAL

Here are some views on selecting the proper coal handling system to fit the job. Evaluating the cost of installation against desired return is exemplified. Handling frozen coal and drying are discussed

WILBUR G. HUDSON, *Consulting Engineer*

OWNERS OF STEAM PLANTS in the smaller capacity range are faced with the problem; will the investment in mechanical handling equipment show a return on the investment. Often it will not — at least in dollars. Sometimes a local contractor will unload cars as delivered for 20 to $30 per car, or 40 to 60 cent per ton. Plant laborers, as part of their regular duties may do the work at a cost of about 40 cent per ton, unless the coal must be wheeled, then the cost may be 60 cent per ton or more. The bad feature is that the siding is tied up for a day or longer — much longer when the coal is somewhat frozen or sticky.

Simplest *expeditor* is a conveyer of narrow-flight type, which extends between ties from the far side of the track, then upward. For a capacity of 30 ton per hr this equipment should cost not more than $3000 installed, and a plant laborer on part time duty will clear a car in three hour, if the coal is flowable. For 25 cars per year the total cost of unloading then might be figured as —

Labor	$ 50
Power & maintenance	50
Interest and charge-off	320
Total	$420

or 33.6 cent per ton.

We have saved only a few cent per ton, but we eliminate the nuisance of a car blocking the siding, that may or may not have weight. For one car per week the total cost comes to about 24 cent per ton, and for two cars per week to about 16 cent per ton. But, a plant using two cars per week needs not only unloading equipment but a storage capacity, which will tide over periods of interrupted deliveries.

In the April, 1950 issue of INDUSTRY AND POWER, coal handling cost figures were given for nine utility plants using from 40,000 to 172,000 ton per year and fourteen larger plants using up to 547,000 ton. Because of fixed charges the "total coal handling cost per ton" is high, averaging 37.6 cent per ton based on an annual labor

Fig. 4—Coal cars are spotted in thawing house, at the left of the silos. This system includes a coal crusher, drying equipment, 12 conveyors and usual feeders

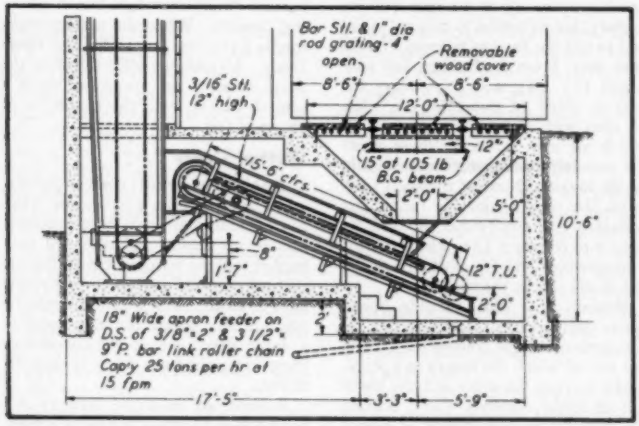


Fig. 5—Typical track hopper and feeder equipment to decrease the unloading time of dump cars. Coal is conveyed by apron feeder to elevator then to storage bins

wage of $1500. This figure is comparatively high because in the small plant two or three men attend to the job as part of their regular work. In the large utility plants there is a standing coal handling squad, which when not unloading cars is engaged in clean-up and maintenance. Furthermore, there is an addition to taxes, insurance, depreciation, and interest, charged to "coal handling".

Quite frequently in small plants there is a floor-level storage bin opposite the boiler fronts into which carloads of coal are dropped. This takes care of the unloading, and there remains the question of whether mechanical handling from the bin to the stoker hoppers is worth while. It may save one or two firemen. It does have the advantage that coal in any section of the bin is made available for any stoker, and the weight of coal burned per day, or if desired coal burned by any boiler may be recorded. Fig 1 is an example. Here there are four stoker-fired boilers. It was required to record the coal burned by each.

A self-feeding L-path continuous flow conveyer-elevator extends along the floor and vertically to a short screw conveyer. A 1200 lb capacity weigh hopper traverses the line of stoker hoppers. This larry has two contactors. One functions to start the conveyer when the larry is brought back to the wall beneath the discharge opening from the screw, and the other functions to stop the conveyer when the filled larry-hopper moves downward slightly as the scale beam poises. Part of the vault storage will not flow to the floor conveyer by gravity, but it is best not to locate a conveyer beneath piled coal. The rest of the coal is held in reserve and must be shovelled over. The installation eases the job of the firemen and gives a check on coal burned.

With a short bin and a single stoker, a loop type elevator, Fig 6, may be provided at small expense. Its operation is fully automatic. A mercury switch stops the elevator when the coal backs up to the top of the chute and another starts it when the feed hopper is nearly emptied. A meter in the chute will give a fairly close check on the weight of coal delivered, if the inclination of the chute is not less than 70 deg, and if mounted where it always is submerged in the coal so the rotor will not spin. Of course the more accurate automatic scale may be provided, but the cost is about $2000 as against $250. The one has an accuracy of within ½ of 1 per cent, the other may have a variation of 2 per cent. The installation shown in Fig. 6 can show no dollar return on the investment, its only advantages were dustless operation, labor easing and weight recording.

Small Plant Handling

Fig. 2 shows a revamped 1950 installation for a small municipal plant averaging one or two carloads per week. Deliveries are fairly reliable though occasionally there is a delay of two or three days, and in the event of a coal strike deliveries may be suspended indefinitely, indicating a large, though inactive reserve storage. Beyond the first boiler there already was a storage vault with a capacity of 200 ton and upon the roof a steel tank with a capacity of 90 ton. Incoming 1¼ in slack coal passes to a bar-flight feeder and is elevated by a bucket elevator at 50 tph. An automatic cut-out near the top of the tank stops the feeder and elevator when the tank and vault have been filled. A by-pass chute extends rearward to form the initial pile of ground storage back of a retaining wall. Coal may be spread indefinitely or reclaimed by a small bulldozer.

Coal in the vault flows to an L-path continuous flow elevator at 10 tph, through an automatic scale and is distributed by a 12 in. screw conveyer. Whenever the three stoker hoppers are filled the screw conveyer stops automatically. This blocks the outflow from the automatic scale, and a moment later the coal has backed up to a cut-out that stops the elevator.

A pushbutton re-starts the screw, the automatic scale resumes operation, and the elevator starts automatically. The only attention required is to start the screw conveyer. This installation costs $23,000 erected, and there is a decided return on the investment. The only operating labor cost is the part time work of plant men clearing the cars.

It happens that the installations illustrated show the continuous flow type of elevator-conveyer. This machine has some advantages where the handling capacity is moderate. It is self-loading to capacity, will not overload and so does not require a feeder. On the other hand, coal, especially when damp or with an acid content, corrodes carbon steel. This action may be serious where the coal remains in contact with the walls of the duct as in Fig. 1 and 6, and the unit feeding to the scale in Fig. 2. The added cost for corrosion-resistant casing is well worth while. A bucket elevator is preferable in an exposed location where damp coal may jam in the up-run of a continuous flow elevator in freezing weather. This determined the type of elevator handling the incoming coal.

Let us now consider a large steam generating station. The coal handling layout becomes much more complicated and the major requirements are reliability of performance and low maintenance — quite difficult with low grade bituminous coals, often wet, sticky or semi-frozen. The outstanding installation of 1949-50 is that engineered by the engineers of the Dow Chemical Co. for their 800,000 lb per hr station known as South Power Plant. The coal, in a section where winter climate conditions are, to put it mildly, bad, may require thawing to loosen it in the cars and substantial reduction of surface moisture since the boilers are equipped with cyclone burners.

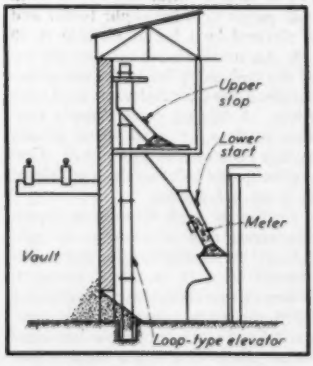


Fig. 6—Loop-type elevator can be coupled for automatic start and weighing

Reserve storage is maintained at the waterside area where coal is discharged by self-unloading vessels, spread and compacted by bulldozer and carryall, and reloaded to cars as required for use. Incoming loaded cars, if the contents are more or less frozen, are placed in a firebrick-lined thawing station, which accommodates four-70 ton or six-50 ton cars. Here there are remote controlled gas burners spaced 3 ft apart in a shielded trench outside the rail. The cars are spotted for thawing by a fireless locomotive, and 15 or 20 min suffice to soften coal adhering to the car-sides and bottom; then they are shifted in pairs to twin track hoppers where a car shaker is lowered into place and the cars are emptied without manual labor. In an 8 hr shift 20 or more cars may be so emptied.

Sequence of Operation

Coal from a track hopper, in Fig. 4, is fed to conveyer (1) at 200 tph, thence to conveyer (2) and into a breaker operating at 14 rpm (60 hp motor), for reduction to minus 1½ in. and to cull out foreign material (tramp iron, etc). From the breaker, belt conveyers (3), (4), and (5) convey the coal to either of two-1100 ton silos. In silos with floor openings through which air may infiltrate, there exists the possibility of spontaneous heating in the lower sections of the mass. Beneath the silos a movable feeder can withdraw coal from either silo and deliver it to conveyer (6), which returns it to conveyer (4) for discharge to the top of the pile in the silos.

Beneath the silos variable speed apron conveyers (7) and (8) feed to a runaround flight conveyer (9), the top run of which discharges to a screw feeder serving the dryer and the lower run to flight conveyer (10). Should the coal not require drying, it passes from conveyer (10) to a vibrating screen and the minus ¼ in. is carried by conveyer (12) to the two-415 ton bunkers. The oversize from the screen passes through a hammermill of 40 tph capacity direct-connected to a 1150 rpm motor, and, by conveyer (11) back to conveyer (10) for re-screening.

Coal to be dried feeds from the top run of conveyer (9) to the dryer. This is a 11 ft 6 in. by 36 ft long machine with a wet feed (15 per cent moisture) capacity of 45 tph of minus 1½ in. coal, discharging it dried to 4 per cent moisture content at 40 tph (5 tph of water is removed) to conveyer (10).

The dryer is rotated at about 4 rpm by a 50 hp motor. The inside of the rotating drum is fitted with tangential and radial louvre plates, which form passages for the hot gas forced in by the inlet fan. As the drum rotates, the coal bed slips at the angle of repose and also moves along toward the discharge end, with no drag against the louvre plates. As the material moves forward the bed becomes thicker, the passages become smaller, and the volume of hot gas penetrating the bed is reduced so overheating is avoided. Exhaust is through a dust collector. The drying gas at 700 F is provided by a stoker-fired furnace, that uses about a ton of coal per hour, and a fan with a capacity of 70,000 cfm. It will be noted that in this independently-fired dryer, about 2½ per cent of the coal dried is used for drying it from 15 to 4 per cent surface moisture. However when drying coal with 8 per cent initial moisture to 4 per cent, the dryer has a capacity of about 80 tph.

It has been found that with surface moisture in excess of 6 per cent there is occasional blinding of the vibrating screen, arching in the chutes and some rat-holing in the bunkers. Any interruption of flow to the cyclone-type burners means immediate loss of steaming capacity. When the surface moisture is 6 per cent or less, the coal flows freely. All units are inter-locked in the usual manner, and controlled from a central station, with the exception of conveyer (6).

Wetted Coals

Problem of small coals especially when wet, has been a tough one. They can be unloaded from hopper-bottom cars by car shaker and conveyed to a bunker without serious trouble, but the difficulty is in getting a continuing flow from the bunker and through the feed chutes. Where the investment in a large dryer cannot be considered, there are procedures more or less effective.

A dryer of moderate capacity — 5 or 10 tph — to reduce the surface moisture of part of the coal to 4 per cent, and mix this dried coal with untreated coal in a proportion that will retain flowability. If the incoming coal will flow through bunker gates, the bunker may be constructed with compartments for this coal, which then may be drawn off, dried and deposited in alternate compartments at or near the consumption rate. From these compartments the coal may be fed to any chute by a horizontal conveyer beneath the bunker.

Dry air jets directed into the lower section of the bunker in the areas of out-flow will aerate the coal, and in that condition it will flow unless the movement is checked and the coal permitted again to compact. Unfortunately coal is not in the class of materials such as cement and soda ash, which injected air completely fluidizes, or that would be a comprehensive answer.

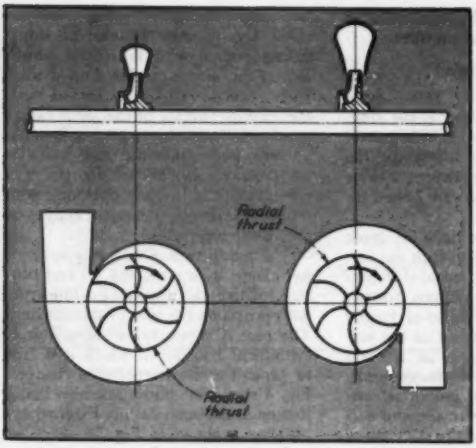


Fig. 1—Volutes on multistage pumps are staggered to balance thrust on shaft. Cross section above, end view below

CENTRIFUGAL PUMPS • • • CONSTRUCTION OF MULTISTAGE UNITS

Part 3*—Pump stages operated in series for high output pressures have resulted in many multistage designs. Choice will depend on temperature, pressure and maintenance requirements

IGOR J. KARASSIK and ROY CARTER
Application Engineers
Worthington Pump and Machinery Corporation

WHEN LARGE CAPACITY, medium high head service conditions require multistage performance, two single stage, double suction pumps may be connected in series on one baseplate with a single driver. The arrangement is very common in waterworks applications for heads of 250 to 400 ft. One method uses a double shaft motor driving series connected pumps at each end, Fig. 2.

In another method, a standard motor is used, but one has a double ended shaft, Fig. 3. The shaft of the pump next to the motor must be strong enough to transmit total horsepower of the unit. When output pressure is relatively high, the casing of the second pump of the unit may require ribbing.

In multistage pumps, series units are combined in one housing. While the majority of single stage pumps have volute casings, both volute and diffuser types are used in multistage units. Advantages of volute casings have been described in Part 2 of the article on centrifugal pumps.

Multistage Pump Casings

The diffuser type pump has advantages in the very high pressure applications because it allows a symmetrical casing, adapted to the vertically split forged steel construction, and simple castings. Its symmetrical form also permits more uniform expansion for extremely high pressure applications, such as 1500 to 2500 psi, and for temperatures over 350 F.

A volute casing gives rise to a radial thrust which increases appreciably in magnitude with increased stage pressures. Most common designs of axially split multistage volute casings use volutes staggered in such a manner that the individual radial thrusts are balanced out as in Fig. 1.

Both axially and radially split casings have been and are being used for multistage centrifugal pumps. Although apparently a recent development, vertically split casings have been continuously employed, especially in high pressure pumps constructed both here and abroad.

Casing Joints

The original centrifugal pumps had a vertically split casing, or rather, one with joints in a plane perpendicular to

* This article will be included in a book on centrifugal pumps now being prepared by the authors; hence all rights to republication are reserved by them.

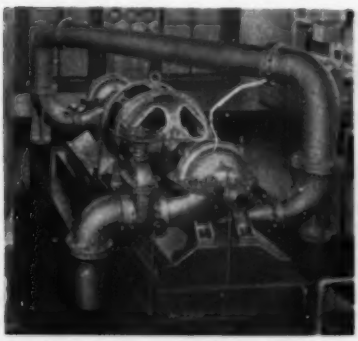


Fig. 2—Single stage pumps in series may be driven by the special motor between them

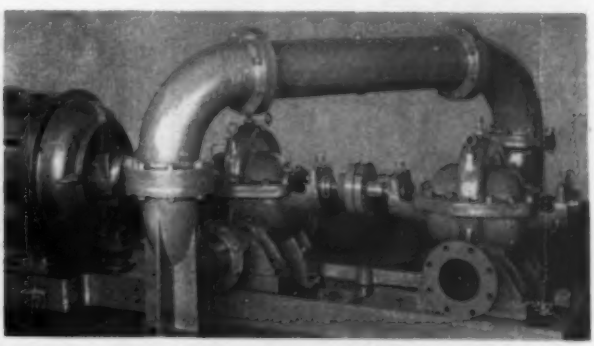


Fig. 3—This method of driving single stage pumps in series uses standard motor but pump in middle must have an extra strong, double end shaft

the shaft axis. Splitting the casing in a plane parallel to the axis of rotation was introduced for accessibility in inspection and repairs. Openings to suction and discharge passages were located in the lower casing half, with the result that the upper half could be lifted and the rotor laid bare for inspection or removal without disconnecting the pump either from its foundations or from suction and discharge piping.

With increased working pressures, horizontally split casings show signs of inherent weakness, primarily because it is difficult to keep the flange joints tight at higher pressures.

The first solution to internal leakage and casing distortion resulting from "breathing" was to increase the thickness of the horizontal flanges, stiffen the casing with properly located ribs and augment number and size of casing bolts. As experience is gained in operation of axially split casing pumps at higher pressures, it is probable that the limit will constantly increase to 1400 or 1500 psi pump pressure.

Axially Split Casings

In the low and medium pressure and capacity range, interstage passages are integrally cast in the casing proper. As the pressures and capacities increase, the desire to maintain as small a casing diameter as possible, coupled to the necessity of avoiding sudden changes in the velocity or the direction of flow, leads to the use of external interstage passages cast separately from the pump casing. They are formed in the shape of loops, bolted or welded to the casing proper.

Generally, gaskets are used at the joint. Attempts to build multistage pumps with a metal to metal seal have not been very successful. In many cases, flanges are machined with a taper so that the gasket is gripped at inside areas of the casing where leakage tends to start because of internal pressure.

Radially Split Casings

The oldest vertically split casing form of multistage pump is the ring-casing or "doughnut" type. When more than one stage was necessary for the generation of higher pressures, two or more single stage units were bolted together.

In general, barrel sections are made of forged or stainless steel with one section per stage, the individual diffusers being inserted into the sections. Suction and discharge heads are also of forged steel. Nozzles were located on the vertical centerline and form an integral part of the suction and discharge heads. Vertical joints between individual casing sections, and between the end sections and the heads, make a metal to metal contact on ground surfaces. Heavy through-bolts hold the assembly together and insure tightness at the vertical joints.

The objection to this design is inconvenience in dismantling. It is necessary to disassemble the pump piece by piece, breaking the suction and discharge connections.

To avoid dismantling difficulties of the "dough-nut" type and retain mechanical advantages of the vertical split, double casing pumps were designed. Development of high-pressure boiler-feed pumps has evolved into various types, similar in principle but different in conception.

Double Casing Pumps

Basically, working parts of a multistage centrifugal pump are assembled in an inner casing and the whole enclosed in an outer housing. The space between the two is maintained at the discharge pressure of the last stage.

The inner casing is either the axially split or the radially split type. The first is a simple evolutionary step from the usual low pressure practice of single casing pumps with horizontal joints. When the unit is enclosed in a solid barrel structure of cast or forged steel, the exterior surface of the inner casing is subjected to pressure greater than the *average* pump pressure and is under compression. Horizontal flanges will remain tight under any operating conditions. Generally, the inner casing is of the volute type.

The pump with a vertically split inner casing is an evolution of, and constructed like, the usual ring casing type, with provision for ease of dismantling. The unit is supported in forged steel cylindrical housing in which it is free to expand under temperature changes. Fig. 4 shows the pump assembly being located in the outer casing. External appearance is shown in Fig. 5.

Suction and discharge nozzles form an integral part of the outer shell, permitting removal of all interior parts without disturbing the pipe connections. Nozzles are located on the vertical center line, either top or bottom, to prevent eccentric strains from the piping which might disturb the alignment of the unit. The most important advantages in this construction are perfect symmetry for all parts of the pump, and ring type high pressure and interstage joints which are most easily held tight under pressure.

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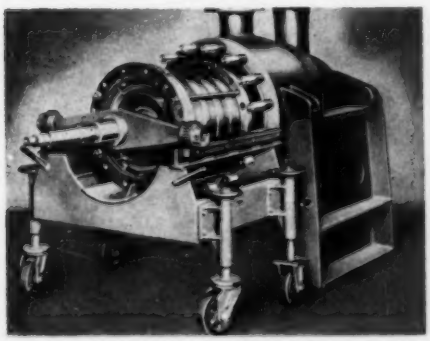


Fig. 4—Working parts of a double casing pump can be removed from outer shell without disturbing piping

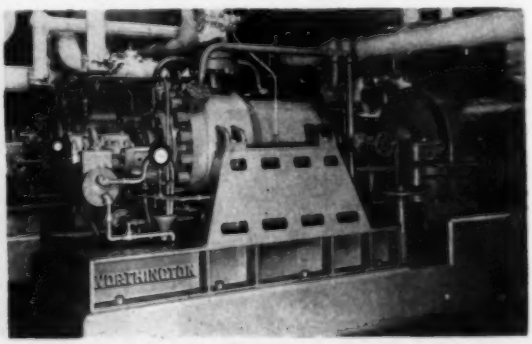


Fig. 5—Outer shell of a double casing pump (in operation above) carries discharge pressure to balance inner shell bursting stress

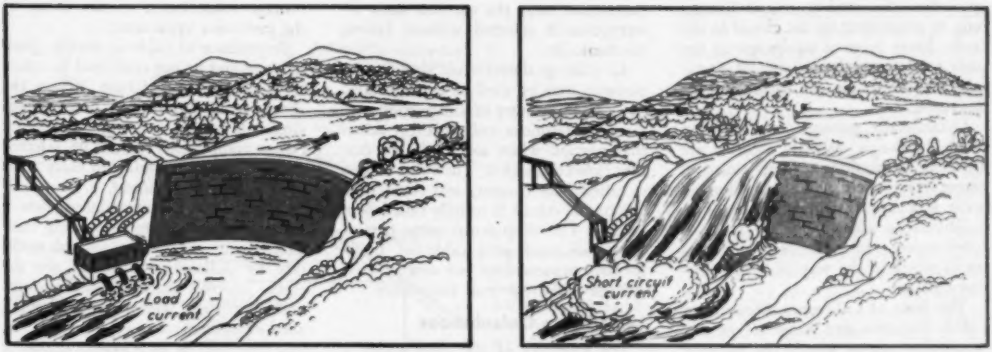


Fig. 1—Distribution circuits must handle not only normal loads but also surges from the utility system during faults

SHORT-CIRCUIT PROTECTION FOR LOW VOLTAGE SYSTEMS

Short circuits can be disastrous when all component parts of a faulted circuit cannot handle the surge. Fault currents may be calculated and limited, or adequate interrupting capacity provided, by these methods which balance cost of protection for a distribution system against loss of equipment and production

SYSTEM co-ordination for low voltage distribution is probably one of the most discussed and least understood problems in the use of electric power in industry. Characteristics of any component part of a system are significant only in the light of their contribution to the characteristics of the network as a whole.

The user of electric power demands a distribution system having a degree of continuity of service and ultimate cost commensurate with the requirements of the load. For example, high interrupting capacity switchgear of highest quality and price is not justifiable where the power supply is incapable of producing heavy, short-circuit currents. Some very misleading conclusions are inevitable concerning the cost, installation, maintenance and operation of power distribution equipment if only individual qualities of component parts are given attention. Circuit breakers, fuses, cable, transformers, safety switches and motor controllers must be carefully co-ordinated and properly applied for uninterrupted power flow.

If a short circuit occurs at any point in a power circuit, amount of current flowing to the fault is limited only by capacity of the power system and impedance of the circuit between supply and point of fault. As a simple analogy, Fig. 1 illustrates a power plant operating from a large reservoir. Amount of water flowing through the plant is controlled by size of the penstocks and their valves. As long as the dam remains intact, the power house is protected. But if the dam breaks, the entire content of the reservoir rushes through the gap, limited only by size of the break. Similarly, the entire capacity of a power system rushes into a short circuit on the distribution lines regardless of size of motors or other

Fig. 2—This fused switch was opened under load and the resulting arc short-circuited the lines. Adequate interrupting capacity in the supply line would have prevented the full power of the system from flowing through the fault and damaging equipment connected in the circuit

apparatus connected to it and limited only by impedance of the circuit to the fault. Every piece of equipment in the path must either be capable of carrying or interrupting the current, or be destroyed.

Occasionally someone asks whether these "blow-ups" actually occur or are academic discussions to help electrical manufacturers sell switchgear. They do occur and in surprising numbers. Fig. 2 illustrates what happened when a fused safety switch of inadequate capacity stood in the way of a short-circuit current.

The State of California, Division of Labor Statistics and Research, is one of the few places where the story of electrical accidents in industry is documented. Statistically, they show that 85 per cent of the electrical injuries for one year occurred on low voltage circuits, 600 v or less. This seems to be the field where most attention is needed to protect against costly failures from short circuits.

Cause of the blow-ups may be heat created by high current flowing through contact or other circuit resistance, or possibly the terrific mechanical forces created by magnetic stress. Magnetic-mechanical forces increase as the square of current. During a short circuit of twenty times normal current, forces exerted at all points in the current carrying circuit are 400 times normal. This relation between current magnitude and mechanical force is shown in Fig. 3. Consequently, not only must a circuit breaker or fuse be capable of interrupting these high currents, but mountings, joints and other parts must carry the currents until interruption is effected without failing mechanically.

In making short-circuit studies, impedance may be used as a percentage. Per cent impedance of any portion of a circuit determines voltage drop across that portion when some selected current flows through it. The value chosen is called base current, and rated voltage of the circuit is usually called base voltage. The drop across some part of the circuit, such as a cable or transformer, expressed in per cent of base voltage is the per cent impedance.

Impedance Calculations

For example, if the drop along a 440 v cable run is 44 v at 1000 amp, per cent impedance of the cable is 100 x 44/440 = 10 per cent on a 1000 amp, 440 v base. If a 10 per cent voltage drop is created by 1000 amp flowing, then a 100 per cent drop will result from a current flow of 1000 x 100/10 = 10,000 amps. This is the short-circuit current, since the voltage at a solid short circuit is zero and all of the input voltage is consumed as a drop across the circuit impedance. Consequently, short-circuit current may be calculated by dividing 100 by the per cent circuit impedance and multiplying this ratio by the current on which the impedance is based.

In most short-circuit calculations, resistance of various circuit components is negligible and reactance and impedance may be used interchangeably. The values for generators, motors, transformers and reactors are available from manufacturers as a percentage value based on the rating of the particular apparatus.

Impedance of cable is usually given in ohms and its per cent must be calculated on the desired base. When the short-circuit current has been found, circuit breakers, fuses and all other circuit components should be selected to have sufficient rating to carry and/or interrupt this current.

Impedances are introduced into a distribution system to effectively limit short-circuit currents by several methods. By judicious application, the designer controls system fault currents and keeps them within limits of available equipment ratings. One of the best examples of such system design is the use of load center substations as indicated in Fig. 4. By dividing the total required transformer capacity into several, relatively small units, the source capacity for each feeder is reduced and current available to a fault is limited.

Suppose an industrial plant requires 4000 kva at 480 v, and that the utility company supplies power at 13.8 kv from a system capable of delivering 500,000 kva to a fault. In a system in which the entire plant load is stepped down in one large transformer, short-circuit currents on the 480 v system can be calculated as follows:

A base of 4000 kva may be chosen for the calculations. Then the effective impedance of the power company source is 100 x 4000/500,000 = 0.8 per cent. A transformer rated 4000 kva, 13800/480 v may have an impedance of 6 per cent. So total impedance in the circuit is .8+6=6.8 per cent. Con-

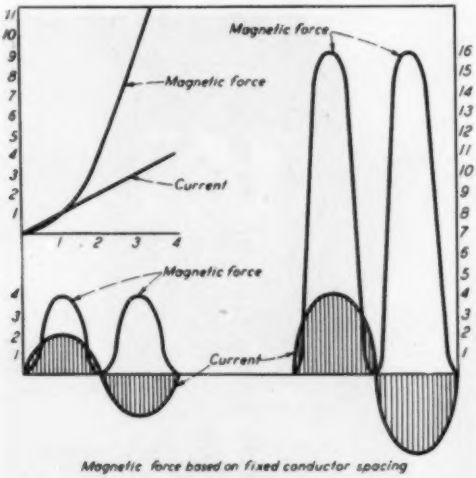


Fig. 3—Equipment must withstand stresses from magnetic forces that increase as the square of the fault currents

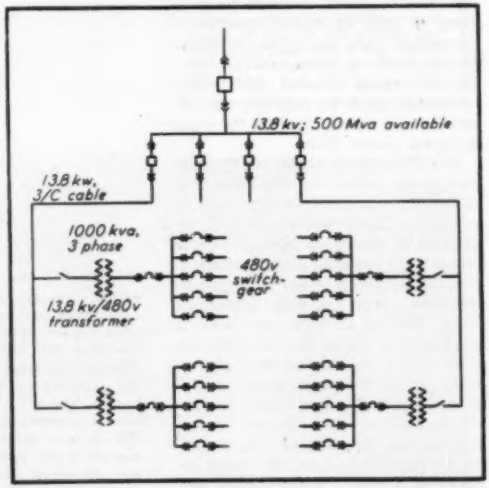


Fig. 4—For same per cent impedance, smaller transformers have higher actual impedance, reduce output fault surges

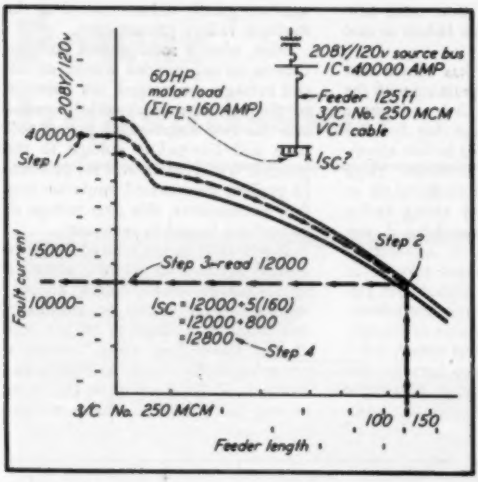


Fig. 5—Curves that show variation of feeder impedance with size and length are available and may be used to find amount any feeder can limit current inrush due to faults occurring on circuits or equipment connected to load end of the feeder

sequently, a fault on the low voltage bus will draw 4000 x 100/6.8 = 59,000 kva (three phase total) or 71,000 amp, rms symmetrical line current.

If a factor of 1.25 is applied for average asymmetrical current and 25 per cent added for generator effect of motors contributing to the fault current, any interrupting device applied to the system must be rated: 71,000 x 1.25 x 1.25 = 111,000 amp. No such circuit breakers are available and some way must be found to introduce additional circuit impedance.

If the plant load is split into four 1000 kva transformers in load center units, each transformer having about 5.5 per cent impedance, short-circuit current calculated on the lower rating is reduced to 33,000 amp, well within the rating of available equipment.

Even a properly designed system may have spots where it is economically unsound to reduce fault currents by using small transformers. In some cases, it may be advisable to introduce impedance by means of current limiting reactors. A low voltage reactor developed for the purpose will fit into a compartment of conventional metal enclosed low voltage switchgear.

Reactors

Reactors have a very limited field of application and must not be used as a cure-all for short-circuit problems. It is not ordinarily economical to use them to reduce size of feeder breakers in a conventional load center unit. When used, they should ordinarily be connected on the load side of the circuit breaker, which then protects reactor as well as feeder. In this case, breaker rating cannot be reduced. If the reactor is used to reduce the size of the feeder breaker, it must be connected on the supply side where it becomes an additional exposure on the bus. This application should be avoided.

There is often sufficient impedance in the feeder cable itself to limit the available fault current to a safe value *at utilization equipment* even though capacity at the feeder breaker is much too high. Curves such as shown in Fig. 5 have been prepared and are used to find the length of various sized feeder cables required to reduce any amount of fault current to any desirable value. Feeder length is probably the most important reason why so many systems "get by" without proper attention to interrupting capacity.

Current Limiting Fuses

Should maximum economic use of load center distribution, proper circuit breakers, reactors, and feeder impedance still leave fault currents at branch circuits beyond the interrupting capacity of normal disconnect and interrupting devices, there are current limiting fuses which interrupt currents as high as 100,000 amp at 250 and 600 v and are Underwriters' Laboratory approved. They are made to standard NEC fuse dimensions and fit standard clips. However, restrictive clips to prevent accidentally replacing them with a standard fuse of lower interrupting ability are available.

A fuse should have an a-c interrupting rating for each continuous rating. NEC fuses do not carry such a specification, but tests have shown that up to the 200 amp size they will handle faults on a bus of 50,000 amp short-circuit capacity when used in a motor starter. With the advent of the current limiting fuse more emphasis is being placed on their rated ability as interrupters. Experience has shown that interrupting capacity of fuses is not predictable or subject to calculation, and the rating must be based on the manufacturer's full power tests.

Selective operation is the second important point to be considered in applying fuses. Current limiting fuses are inherently fast. For example, a given 100 amp fuse will melt at 2000 amp in 0.6 c (60 c basis) and will clear the arc in another 0.6 c, or approximately 1.2 c for complete interruption. This is exactly the type of performance desired for application to branch circuits where current of over ten times normal indicates a fault to be isolated before feeder breakers open.

The extremely rapid operation of these fuses, however, is not adjustable. Accurate time-current characteristics must be known, and careful selection made to have a properly co-ordinated, selective system that will give minimum shut down in case of fault. In general, application of current limiting fuses and the devices protected by them should be reserved for branch circuits.

Circuit Breakers

In applying circuit breakers to low voltage circuits, there are two types of operation, selective tripping and cascading. In selective tripping, each feeder breaker has an interrupting rating capable of protecting the feeder against the maximum available bus fault current. Thus the trip settings of the feeder breakers and any back-up breakers may be coordinated so that a fault on any feeder will trip the breaker protecting that circuit only, giving maximum selectivity and minimum outage. This system should be used for important loads where down time is costly and where the extra investment in larger, full capacity breakers is justified by superior protection.

Cascading is a method of using smaller, less expensive feeder breakers which give adequate protection but a much lower degree of selectivity. Tests have indicated that modern, low voltage air circuit breakers having magnetic trips may be successfully applied to circuits where the available short circuit current is twice their rating, provided they are backed by a breaker of full interrupting capacity having its overload trip set at 80 per cent of the smaller breaker rating. Any fault current in excess of the trip setting will open the back-up breaker, protecting the smaller unit, but de-energizing all feeder circuits connected to the back-up breaker. This system will decrease investment, but it must be remembered that one shutdown of an entire plant

may often be many times more costly than the savings realized.

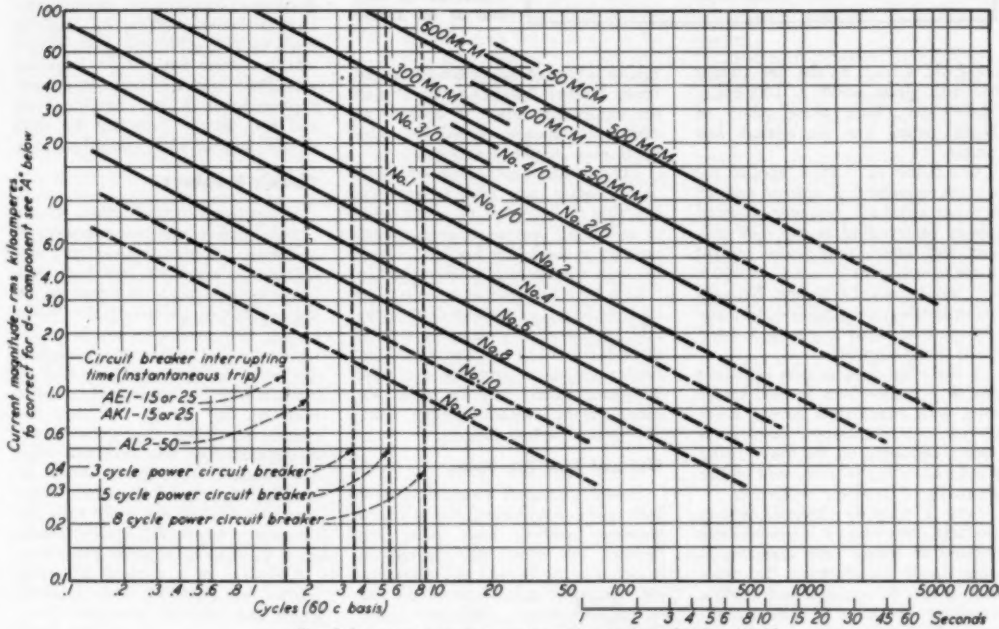
Available short-circuit currents, breaker or fuse interrupting time, and feeder cable size should be co-ordinated to avoid severe permanent damage to cable insulation during a fault. Reasonable maximum peak transient temperatures for various cable insulations have been designated and in general allow about 150 C maximum copper temperature during the flow of fault currents.

The problem, then, is selecting a cable large enough to limit the maximum temperature to this value when the available fault current flows for the period of time required by the protective device to clear the circuit. Curves in Fig. 6 give cable size if the fault current and interrupting time are known. Smaller cable than indicated will result in a very short cable life, or even immediate cable failure in case of short circuit.

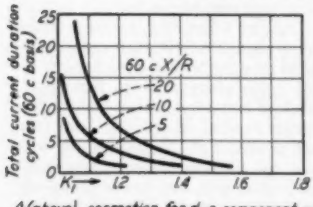
Finally, experience has shown that a low voltage system operating with the neutral solidly grounded will have fewer outages, and those that do occur from ground faults will be less expensive and of shorter duration. High voltages to ground are produced on an underground system by arcing faults, and even by normal switching if one phase of the system is accidentally grounded. These voltages may be as high as 5 or 6 times normal and frequently cause insulation breakdown, sometimes at several points of the system. A grounded neutral system has a well defined impedance between the system neutral and ground. When this is low, magnitudes of transient voltages are greatly reduced, avoiding the multiple failure phenomenon.

Also, when a solid ground fault occurs on an ungrounded system, no circuit breakers are tripped, but potential of the system neutral will be raised and the two ungrounded phases will have full line-to-line voltage to the ground. When maintained for protracted periods, deteriorated insulation may fail. Furthermore, this over-voltage to ground is a hazard to personnel.

If the fault is not cleared before a ground appears on another phase, a double outage results. Solidly grounding the neutral limits the maximum line-to-ground voltage to 58 per cent of the line-to-line value, isolates a grounded feeder circuit, and helps materially in locating a fault so that service may be restored in minimum time.



For other temperature ranges see "B" below – for aluminum, time is 45 per cent that for copper



A (above) – correction for d-c component – rms amp = symmetrical amp × K_f

B (right) correction for other temperature ranges – time = $K \times t_1$

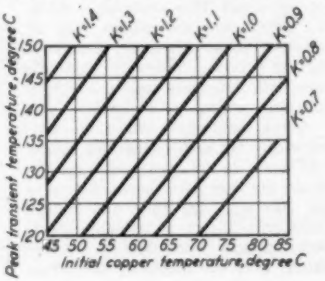
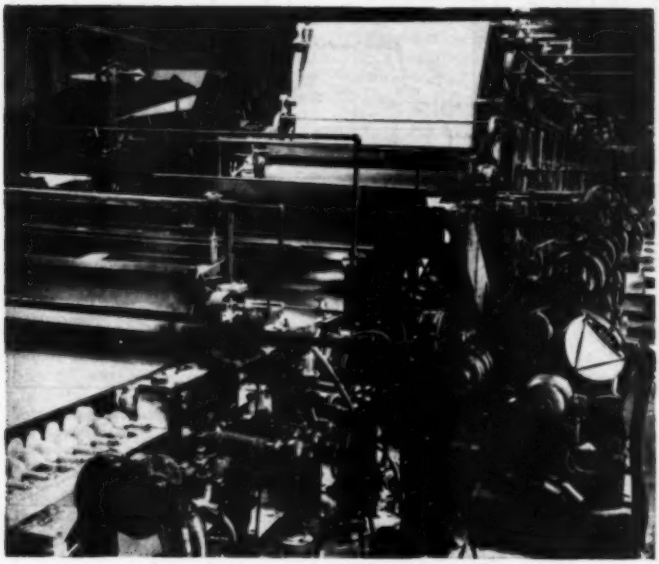


Fig. 6—What is the maximum value and time for fault currents without damage to cable insulation? The answer, which is as important as maximum load value, is given in the chart above. Smaller charts at left show correction factors for less common temperatures and cables found in industrial plants

Editor's Note: Data and information for this article were prepared for INDUSTRY AND POWER by K. C. Moberry, Application Engineer, General Electric Company.

Power transmission

Engineering data and information to aid in selection, application and operation of equipment used in transmission of mechanical power



Electronic speed controls have eliminated cumbersome and inaccurate mechanical adjustments in sectionalized paper machine drives. Now, by these methods, speeds are held to 0.05 per cent, are quickly changed as needed for draw control

HERBERT CHASE

Fig. 1—Paper making machines are typical of operations divided into sections where rolling, or other process speed, must be carefully synchronized. Speed and tension at seven stations on this machine are correlated electronically

SPEEDS AT MULTIPLE STATIONS ARE MATCHED ELECTRONICALLY AT TYRONE

IN paper making machines the wet pulp is deposited on a fast moving screen in the form of an endless belt that catches the fibers and permits much of the water to be drawn off, leaving a blotter-like continuous sheet. This is picked up and passed between or over several sets of rolls that compress and dry the sheet and calender it before the resulting paper is wound onto a reel.

When wet, the sheet is weak and, although toughness increases as water is removed and the sheet is compressed, the strength is never high. Nevertheless, in passing through successive stages or sections of the machine a certain tension or "draw" must be maintained, resulting in some stretch. Unless proper draw occurs at each stage, quality varies and the sheet is likely to rupture. Then the machine must be rethreaded, during which time its output of acceptable paper is curtailed.

Exceptionally close control of speed in each section of the machine is essential. The higher the speed, the faster the control response must be.

Sectional Drives

Modern paper making machines often consume several hundred horsepower. This power is divided among the sections, each of which has its own motor driving through a suitable speed reducer. To maintain close speed control and still be able to vary speed slightly to maintain draw, d-c motors are employed and receive power from a common motor-generator set or from individual sets. Speed regulation is obtained by varying field strength of driving motors when power is received from a single unit and by varying field strength of individual generators when they are used to provide motor power.

Until recently, speed control was mechanical, linkages being arranged to adjust rheostats varying the field strength of driving motors. Manual adjusting stations were not always easily accessible, or so quickly responsive as desired.

Machines No. 2 and No. 3 at the Tyrone, Pa., plant of the West Virginia Pulp & Paper Co. were approximately 20 yr old. Paper speeds were to be stepped from 550 fpm to 600 and 750 fpm. Original units had conical pullies and belts that could be shifted, and that drove through differential devices to screws determining the setting of field rheostats on driving motors.

The decision to install what is believed to be the first all electronic control unit ever applied to a sectional

paper making machine was made. Westinghouse engineers cooperated closely in making the changeover, having designed and built the new type of equipment required.

Driving motors and speed reducers were not changed. They receive power from a generator set driven by a 25 c three phase motor on the plant line from the company's own 8600 kw generating station. As higher speed required more power, No. 3 machine required an auxiliary motor-generator set which is also provided with electronic controls.

Fig. 1 gives a general view of No. 2 paper making machine as it appears from the driving side and looking from the wet end or couch (left foreground) toward the dry end (background) where the finished paper is reeled off. This illustration shows most of the driving motors and some of the reducers by which they are connected to the several machine sections. The general arrangement is shown diagrammatically in Fig. 2.

It is essential not only that the speed of each motor be controlled automatically within close limits but that each motor hold a speed in reference to those driving adjacent sections so that the desired draw is always maintained on the paper at each point in its passage through the machine. Actually, the draw does not remain constant at any given point but often must be manually altered by skilled operators to meet different conditions and to hold quality constant.

Basic components in the electronic control are indicated in Fig. 3. A static master-reference voltage source is supplied to which the output of the tachometer generator attached to the driving motor of each section is compared. These tachometers are all identical and, of course, indicate section motor operating speed. In Fig. 4, showing the drive for the couch section, the tachometer generator, directly connected to the section drive motor appears in the foreground of the picture.

Control System

In operation, an a-c voltage signal from the master reference source and a similar signal from a section tachometer feed into the "error-detecting" element of the electronic regulator for this section. These two voltages balance when the section runs at its nominal speed and the grid-controlled thyratron rectifier supplies the section motor shunt field with excitation required for operation at nominal speed.

If the regulating system is in correct balance, any slight decrease in section motor speed (say for example one resulting from a slight load increase) is detected by an "error" voltage or dif-

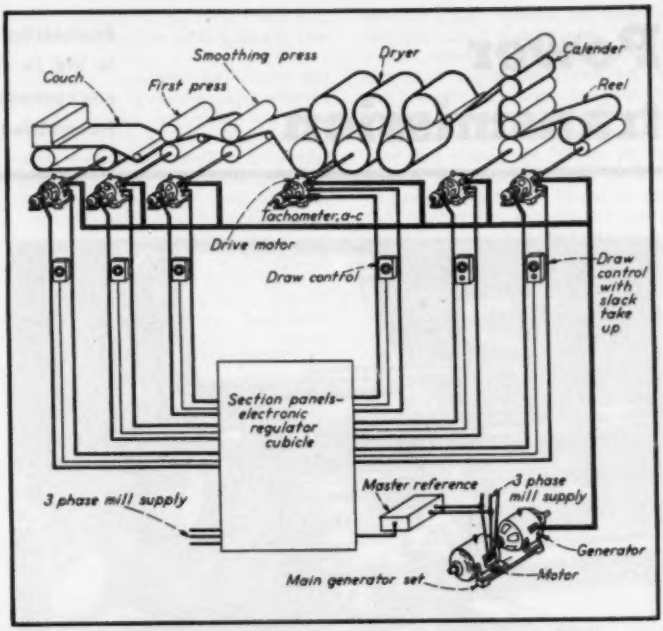


Fig. 2—General arrangement shows how section motor speed must be coordinated to maintain proper take-up and tension on the paper strip. With common d-c power supply as shown, motor fields are controlled by electronic section-panels

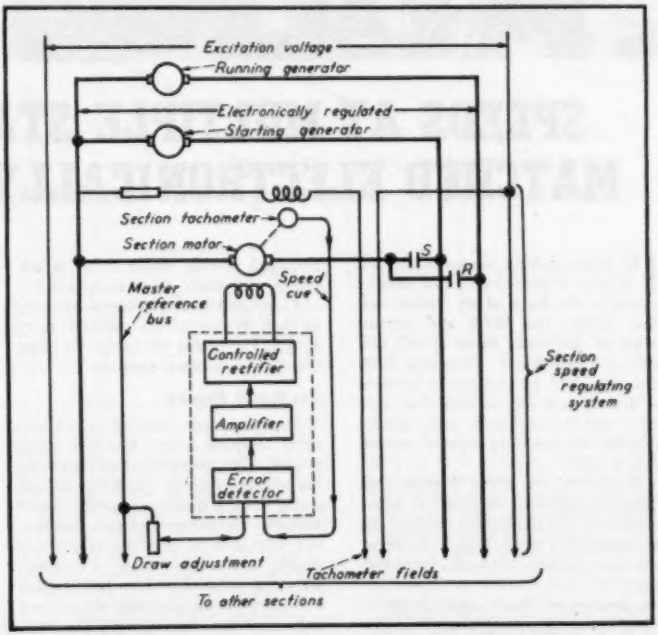


Fig. 3—Output of tachometer on each section motor is compared to the preset reference voltage. Any "error" is amplified and readjusts motor field current for proper speed and torque. Draw adjustment changes reference to maintain tension

ference between the voltage signals from the reference and section speed cue. The difference is amplified and decreases output of the controlled rectifier. Thus, the shunt field of the particular section motor is weakened, permitting the motor to assume the load increase without appreciable speed decrease. Such action is instantaneous, minimizing transient and steady-state errors.

Similarly, if the section motor tends to increase its speed, an error voltage in the opposite direction causes similar events in reverse sequence. The error signal is also proportional to the *rate* of speed change (as well as to the magnitude) and powerful corrective action is initiated before the actual variation becomes significant. In consequence, large changes are prevented. Steady-state accuracies are believed to be within plus or minus 0.05 per cent, with the result that "draws" retain the preset values.

The control circuit is designed to avoid hunting tendencies, or at least to hold them below significant values. Initial adjustment of regulators is made by small potentiometers located on the regulator panel. Frequent checks to attain optimum performance are unnecessary on this setting.

Draw Adjustment

Manual adjustments of draw, Fig. 5, are made by altering the magnitude of reference voltage signal fed to the error detector. Decreasing this voltage slows the corresponding section motor. Only small rheostats are needed and are conveniently located on the tending side of the machine at the operator's control stations. A vernier type of rheostat makes fine adjustment possible.

Impedance of electronic circuits is low and all components of the controllers are of high quality, so as to insure reliability. Thermal time lag of the vacuum tubes is so low that it is not easy to tell when any given section is put under control.

All eleven section regulators for No. 3 machine and a spare unit can be located in a single cubicle. No. 2 cubicle contains eight regulators and is located near the machine to facilitate checking and maintenance operations. Each hinged section of the panel, accessible from both front and rear, includes an error-detecting element, amplifier panel, and the grid controlled thyratron rectifier. A plug-in cable makes connection of the spare unit in place of any of the other units a matter of minutes in event of trouble or during routine checks.

Maintenance

Since the tachometers are induction type a-c machines, brushes, as well as erratic operation from their varying drop are avoided. Periodic checks of electronic tubes constitute the chief maintenance required on control units and thyratron tubes need be replaced only upon failure, as the latter does not interrupt operation.

Illustrations apply especially to what is called the No. 2 machine which was the first converted to the new method of control. No. 3 machine, which includes coating units and requires eleven regulators, has also been converted.

Although paper making machines are not basically of the constant speed type, they are preset to operate at the selected production rate (though requiring means for sufficient speed variation to produce draw, as already explained). It is necessary, of course, to wind the paper under constant tension onto reels as it is produced. As the reel slowly but steadily increases in diameter, speed of rotation must vary to keep peripheral speed constant. Change in rotational speed is great because the diameter gradually increases until three to four times the initial size is attained.

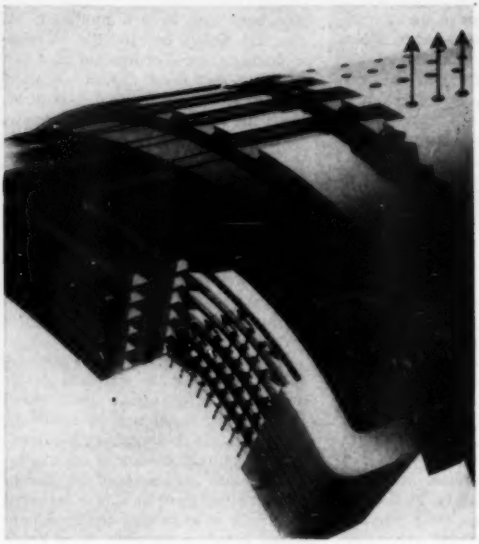
It follows that the reel must either be driven by a motor capable of a wide speed variation or that, if a constant speed motor is used, some drive capable of constantly varying speed must be employed. In this plant, Westinghouse automatic rotating regulators are used on some reels and Louis Allis drives on others.

The latter type includes a constant speed a-c motor of standard design driving an eddy current clutch whose output speed is adjusted by a rheostat that varies clutch magnetizing current. Nearly constant tension is maintained on the paper, but the speed is varied by manual adjustment in almost infinitesimal steps so as to keep the same peripheral speed on the reel. With either type of reel drive, it is possible to keep the reel turning at the required speed, either by hand control of a rheostat or by an automatic device that moves the rheostat slowly as the reel increases in diameter.

Much might be done, if space permitted, in adding details to the foregoing outline on methods employed in this plant in applying power to paper making equipment. From the particulars given, however, it is clear that the switch to electronic controls on paper making machines has resulted in substantial benefits. Now that the pioneering phase of the change is largely past, it is expected that benefits will continue in the form of higher output and better quality of the paper.

Fig. 4—Mounting for the a-c tachometer is shown in a view of motor for couch section. The original drives are used

Fig. 5—Draw adjustment rheostats are conveniently located for operation. Previously, making adjustments was difficult



INNER COOLING FOR

Newly developed method forces high pressure hydrogen through hollow conductors, removing heat from the copper itself, and permits:

- **High currents at low insulation temperature.**
- **Up to 50 per cent increased capacity.**
- **Savings in copper, iron and operating costs.**
- **Better electrical and mechanical efficiency.**

Fig. 1—In the new design, rotor conductors are hollow and allow compressed hydrogen to absorb the heat at the source

TURBINE GENERATORS, with a radically new method of cooling, may have greatly increased maximum ratings. Basis of the new ventilation technique is to cool the active conductors internally by making them hollow and blowing hydrogen gas at high velocities through them.

This method of ventilation has been carefully tested on large size models. The results have warranted its application to two 3600 rpm generators, rated at 175,000 and 200,000 kw, to be completed in 1954.

Several utility systems are of sufficient size and closely integrated by interconnection with other similar systems to justify generating units of 200,000 kw capacity and larger. The cross-compound type of steam turbine generating units can be built for ratings up to 300,000 kw capacity at 3600 rpm, or a combination of 1800 and 3600 rpm. Generators for this type of unit could deliver their kw output ratings at power factors of 0.8 to 0.85 and short-circuit ratios of 0.8 to 0.9 when using hydrogen gas pressures of 30 psig with standard rotors.

Since the tandem compound turbine generator unit has fewer bearings, higher output efficiency, lower capital and operating costs, and requires less space in the generating plant, there is an economic need to develop it for larger ratings. Although tandem connected generators can also be built for ratings up to 300,000 kw, this type would probably represent few advantages over the cross-compound unit.

On the basis of available materials, present design practices, generator characteristics, and conventional construction, single-unit generators can be built at 3600 rpm for maximum rating of 200,000 kw or slightly larger at 0.85 pf, 0.8 scr, and 30 psig hydrogen pressure. The rotors of the units for these large ratings would operate above the first and probably above the second critical speed. At 0.9 pf and 0.5 scr, the maximum generator rating could be increased to 230,000 kw.

New Method

The answer to a substantial increase in capacity is believed to lie in internal cooling of rotor and stator windings with high density hydrogen. This offers possibilities of greatly increasing the amount of copper losses that can be dissipated for a given maximum temperature rise. With heat flow through the insulation of the windings almost completely eliminated, temperature of the windings is determined by temperature of the hydrogen gas in contact with the copper, and the heat transfer coefficient from copper to the gas.

Curves in Fig. 2 show the obtainable rotor ampere conductors per slot from tests on a full size stationary model, with the average and maximum copper temperature maintained the same for the two types of construction. The lower curve is for the conventional rotor design with external cooling, and shows that further increase in hydrogen pressure will offer very little increase of rotor ampere conductors. On the other hand, the benefit with hollow conductors is much higher.

A section view of a rotor and rotor winding, Fig. 1, shows the path of the hydrogen gas flowing through rotor conductors for a particular type of construction. Rotor winding insulation problems are fundamentally the same as for present conventional construction. Creepage paths of the conductors at the central discharge sections are of the same magnitude as for the end turns of present machines.

End turn blocking is further simplified by elimination of gas flow between coil sides and use of a constant cross-section of copper for the circumferential portion of the rotor end turns. In this type of rotor, conductors are necessarily of large cross-section and few in number. With rotor ampere-conductors vastly increased by internal cooling, field current is large, field voltage relatively low, and excitation input approximately twice that for a generator rotor of conventional design. Rotating coil models of large size have been built and tested to demonstrate that internal blowers mounted on ends of the rotor can deliver the required mass of hydrogen through the rotor conductors.

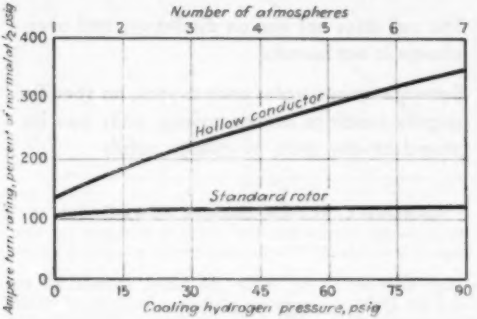
These remarks have applied only to rotor cooling. Similar benefit can re-

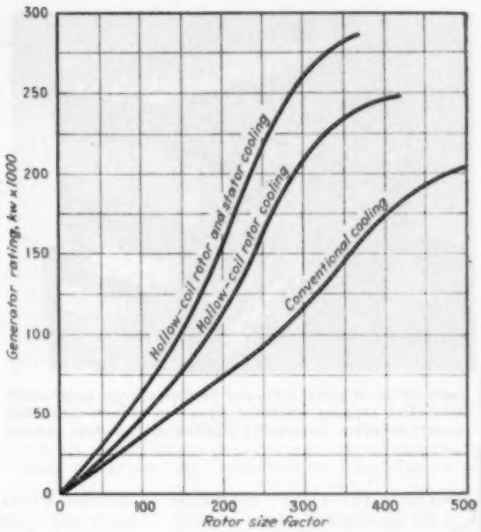
Editors of I&P obtained material for this article at a press conference in Hotel Astor, New York City, where C. M. Laffoon, Manager, Generator Engineering, Westinghouse Electric Corp., made the first public announcement of this development.

GENERATOR WINDINGS

Fig. 2 (below)—Increased pressure improves cooling effect of hydrogen in contact with bare walls of hollow conductors

Fig. 3 (right)—Curves showing effect of internal cooling based on 0.85 pf, 0.80 scr and 30 psig hydrogen pressure





sult from internally cooling the stator coils. The insulation problem is more difficult because of the higher voltage involved and the need for creepage paths of greater length over that required for the rotor. With machines in which cooling can be accomplished by passing the hydrogen gas through the full length of the coils, creepage problems are relatively simple and no difficult mechanical and ventilation problems are involved. In longer machines, in which a central hydrogen discharge is required, the creepage problems are more difficult but do not appear to be unsolvable. Present development of the inner-cooled stator coil has not been carried to the same stage as for the rotor.

Reductions in Size

The curves of Fig. 3 show what can be expected of internally cooled rotor windings and both rotor and stator windings as compared with conventional designs. Kilowatt ratings are based on 0.85 pf, 0.8 scr, and 30 psig hydrogen pressure. From a magnetic standpoint, no changes have been made in flux densities in the stator and rotor portions of the magnetic circuit. In comparing physical dimensions of a 200,000 kw unit for the two types of design, the size factor for the rotor with inner cooling of the conductors is only 62 per cent of that for the conventional rotor.

In the case of internal cooling for both stator and rotor windings, the rotor size factor is only 50 per cent of that for the conventional machine of the same rating and performance characteristics; a similar reduction in the size factor for the stator would also be obtained.

Development of internal cooling with high pressure hydrogen gas opens up a new era in design and construction of turbine generators without too great a departure from present practice and experience. The increased output per unit of generator weight makes smaller units possible for a given rating, and appreciably larger maximum ratings at 3600 rpm than heretofore obtainable with conventional designs. Overall efficiency performance, including generator bearing losses, will then be essentially the same as for units of present conventional designs.

The increase in copper losses of stator and rotor windings due to higher current densities is more than offset by reduction in bearing losses resulting from the smaller bearings required for the smaller rotors, and the reduction in rotor surface losses resulting from the appreciable increase in radial length of the air gap and decrease in rotor surface area. Increase in ventilation loss due to higher fan pressures is partially offset by reduction in volume of gas to be delivered by the blowers.

For turbine generators with internal cooling of the conductors, excitation and terminal voltages are lower than for similar ratings of conventional design because of the mechanical requirement for larger overall section for rotor conductors, and inherent limitations in insulation surface creepage at the inlet and discharge sections of the conductors for both windings.

Internal cooling of rotor and stator windings of turbine generators with high density hydrogen is particularly applicable to units of 90,000 kw and higher ratings. The improved cooling allows ratings much larger than now possible with conventional gas cooling. For 3600 rpm, single-unit generators ratings of 250,000 to 275,000 kw now appear possible at power factors and stability characteristics suitable for the large electric utility systems. Under present conditions, reduction in physical size of generating units for a given rating is of paramount importance since it results in the conservation of copper and steel.

Economic Effects

Although cost savings resulting from use of less material are more than offset by the large development cost now required, large capacity turbine generator units should result in lower overall station capital and operating costs without sacrifice in efficiency. Reduced physical size of the rotor element simplifies forging and results in improved mechanical performance and reliability.

In addition to the two large machines now being constructed with internally-cooled rotors, a 90,000 kw, 3600 rpm generator, using internal cooling for both stator and rotor windings, is now being designed and is expected to be built and available for testing during the latter part of 1952.

Installation of nickel cadmium batteries in an unattended substation supplies electrical power to remote-controlled circuit breakers, emergency lighting and control service

CHARACTERISTICS OF

- **Active materials are compounds of nickel and cadmium operating in an alkaline electrolyte, and the chemical reactions are reversible**
- **The cell does not gas on discharge, and overcharge is not harmful**
- **Battery requires water once a year, no specific gravity readings are necessary, units can be stored at any state of charge safely**

HAROLD L. FLYNN, *Eastern News Editor*

CHARACTERISTICS responsible for the increased interest in nickel cadmium storage batteries are their reduced maintenance costs, long life and reliability under severe operating conditions. A number of companies in various industries are evaluating these characteristics as a means of hedging against materials shortages and a tight labor supply. This is particularly true in the marine, railroad, utility and transit fields.

Surprisingly enough, although the nickel cadmium battery has been manufactured abroad on a large scale for nearly half a century it did not appear on the American industrial scene until 1945.

Active materials in these batteries are compounds of nickel and cadmium operating in an alkaline electrolyte. Nickel-plated steel cells are mounted in hardwood trays to make up batteries of the desired voltage. Available capacities range from approximately 10 to 600 amp-hr.

Positive plate consists of nickel hydroxide and a specially treated graphite, while the active material of the negative plate is a mixture of oxides of cadmium and iron. The electrolyte is a solution of pure caustic potash in distilled water, having a specific gravity of 1.190 to 1.210.

Positive and negative plates are thin, flat perforated steel pockets in which the active materials are held so that electrolyte may reach all parts of the plate. Since the electrolyte is alkaline, there is no corrosion of the plates or active materials.

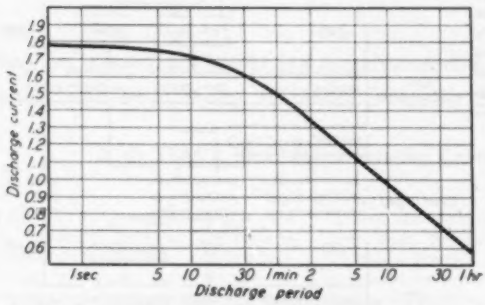
Plates are separated mechanically

Active materials in these batteries are compounds of nickel and cadmium operating in an alkaline electrolyte. Nickel-plated steel cells are mounted in hardwood trays to make up batteries of the desired voltage. Positives plate consists of nickel hydroxide and a special treated graphite, while the active material of the negative plate is a mixture of oxides of cadmium and iron. The electrolyte is a solution of pure caustic potash in distilled water and has a 1.190-1.210 sp gr

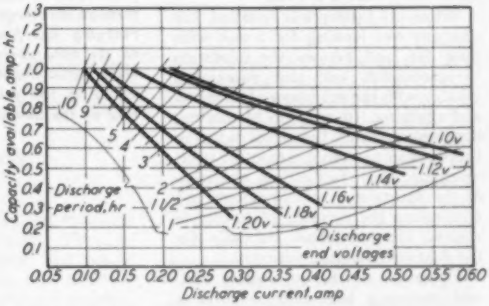
TABLE OF COMPARATIVE BATTERY CHARACTERISTICS

	Nickel cadmium	*Edison*	*Lead*
Weight	Heavy	Light	Fairly light
Volume	Large	Small	Depends on cell
Internal resistance	Low	High	High
Discharge voltage curve	Flat	Sloping	Fairly flat
Charge voltage curve	Low, sudden rise at end	High, slow rise throughout	Low, sudden rise at end
Voltage regulator control	Easy	Difficult	Easy
Can be trickle charged	Yes	No	Yes
Rate of self-discharge	Low	High	High
Mechanically strong	Yes	Yes	No
Damaged by high temperature	No	No	Yes
Damaged by low temperature	No	No	No
Damaged by freezing temperature	No	No	Yes
Water consumption	Low	High	Not too high
Lead battery charging equipment useable	Yes	No	——
Cell gases at end of charge	Yes	Yes	Yes
Cell gases throughout charge	No	Yes	Yes
Capacity reduced by overcharging	No	No	Yes
Capacity reduced by occasional overdischarging	No	No	No
Capacity reduced by frequent overdischarging	Yes	No	Yes
Capacity easily restored by overcharging	No	Yes	No
Number of plates per cell	Large	Small	Small

THE NICKEL CADMIUM BATTERY



Time for potential to reach cell end voltage varies as discharge becomes a larger fraction of C (based on 8 hr rate)



Discharge characteristics show per cent nominal capacity C (based on 5 hr rate) for various fractional discharge ratios

and insulated electrically from each other by polystyrene rods resting in vertical grooves in the plate faces. Hard rubber sheets separate the plate groups from the nickel plated steel container.

Threaded steel posts pass through liquid-tight insulating glands in the cell lid and carry nuts for clamping flat, strap-type nickel plated copper inter-cell connectors, enabling individual cells or trays to be easily added or removed from the circuit without special tools.

Chemistry of the nickel cadmium cell indicates that:

1. Nickel cadmium is a secondary — not a primary — cell and chemical reactions are perfectly reversible.

2. Active materials are insoluble in the electrolyte. No open circuit reaction similar to sulfation in lead batteries can occur.

3. Active materials cannot react with the electrolyte when the battery is on open circuit. Oxides and hydroxides of nickel, cadmium and iron are inert when immersed in caustic potash solution.

4. Specific gravity of the electrolyte does not change through a complete cycle of charge and discharge. This enables the quantity of electrolyte to be reduced to the minimum and the plates to be placed very close together, about 1/32 in. apart. Internal resistance is thereby brought down to values, which enable the battery to be used for high rate discharge applications such as switch closing and engine starting.

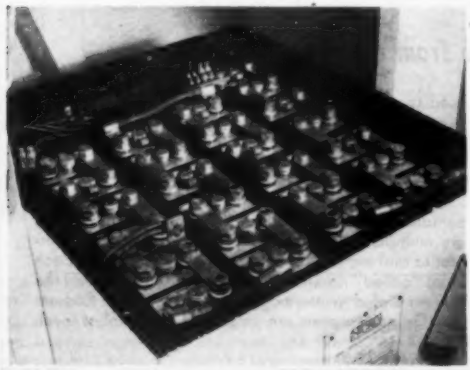
5. As long as the plates are covered by the electrolyte, capacity of the cell is independent of quantity of electrolyte present in the cell.

6. Cadmium oxide will reduce to cadmium at a voltage less than 1.47 v, the dissociation voltage of the electrolyte, but above 1.33 v the open circuit voltage of the cell. Thus, the cell can be fully charged without gassing, provided the charge period can be suitably extended. Bulk of nickel cadmium batteries are used with charge voltage regulated equipment having the same setting and characteristics as used for lead batteries. Under these conditions, an individual cell charge voltage of 1.40-1.50 v is rarely exceeded. Cells are generally floated at 1.38-1.42 v and trickle charged at 1.40-1.45 v.

7. The cell does not gas on discharge. In most applications the charge voltage is below the gassing voltage of 1.47 v. Batteries may be placed quite close to instruments without fear of corrosion.

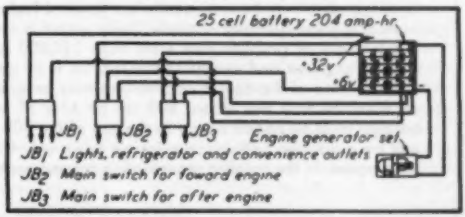
One of the outstanding features of the nickel cadmium battery is that overcharging has no harmful effect, a particularly desirable characteristic in trickle-charge applications.

An interesting installation at the



This 25 cell nickel cadmium battery is installed on a barge to start diesel engines and supply other electrical power

Wiring diagram of 25 cell battery installed on barge shows electrical circuit to diesel engine, lighting and generator



Manayunk substation of the Philadelphia Electric Co. supplies a nominal 125 v, 2-wire service to remote-controlled circuit breakers, emergency lights and to the receiving end of a supervisory control service.

When the battery was installed, the company was looking for a unit with long life, and, because the substation is unattended, one that functioned reliably with the minimum of attention and checking. In addition to meeting these requirements, the nickel cadmium battery does not require monthly overcharging, thus facilitating operation of the supervisory control system and eliminating the necessity of having to operate the substation manually for the 8 hr overcharging period.

Operation of the supervisory control receiving equipment requires a voltage range between 105 and 135 v (1.11 and 1.42 v per cell), and this is below the gassing point of 1.47 v for this type cell. Because the battery voltage does not reach the gassing point, no water was added during the year it has been in operation, and the battery is in good condition.

The nickel cadmium battery can be stored in any state of charge for long periods without attention or fear of deterioration. Its low self discharge and the absence of sulfation eliminates the need for attention during an idle or non-operating period.

Experiences in the railroad industry paved the way for the development of a battery engineered specifically for the starting of railroad diesel engines. It is designated the "T" type and is lighter in weight than conventional batteries. Two sizes are available; a 142 amp-hr unit, interchangeable with 284 amp-hr conventional storage batteries and a 210 amp-hr unit interchangeable with 426 amp-hr conventional batteries.

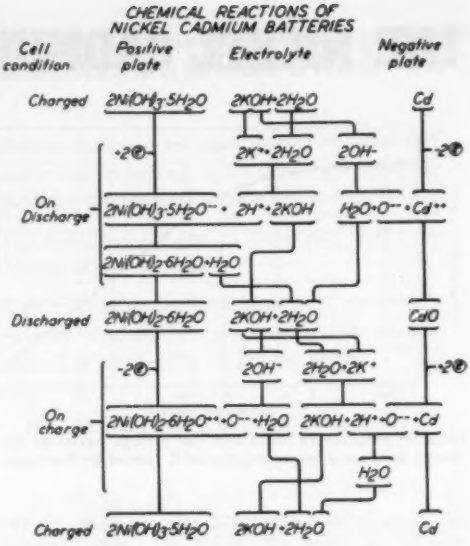
Nickel cadmium batteries are being more extensively used in the marine field, particularly in new construction. Among the lines using nickel cadmium batteries are Alcoa Steamship Co., Robin Line, Esso Standard Oil Co., Socony-Vacuum Oil Co. and the American President Lines.

Heavy duty power demands made on batteries in auxiliary lighting, engine starting, radio communications and other equipment at sea requires a reliable source of power, an inherent characteristic of the battery.

Recently, a 32 v battery replaced three 32 v batteries previously required to operate two diesel pumping engines, lighting and electrical equipment on an oil barge of a major oil company. In addition to this economy, at least 20 hr or charging time a week was saved. Generally, in floating applicasions large charge and discharge currents are handled with small voltage fluctuations.

Maintenance routine on nickel cadmium batteries varies slightly, depending on the application, but is relatively simple in all cases. These batteries require water about once a year and they should also be cleaned externally about once a year. No specific gravity records are necessary. When charged by the constant current method at heavy rates they may require an electrolyte change every four or five years. With stationary batteries on trickle charge or float, where the charge voltage does not exceed 1.50 v per cell, the electrolyte is not changed throughout the life of the battery.

Characteristic chemical reaction flow of a nickel cadmium battery cell in various stages of the complete cycle of charge through discharge to charging and finally to the fully charged state. Basic chemical action is the oxidation of the cadmium



The Cover— More Gasoline From a Process Giant

• The striking night view of part of Plant 5 at the Sun Oil Company's Toledo Refinery pictures the big Houdriflow Catalytic Cracking (HCC) unit built to make more gasoline—and consequently less residual fuel oil —from a given quantity of crude. Daily output is over 500,000 gal of gasoline plus more than 120,000 gal of light naphtha and nearly 12,000,000 cu ft of gas.

Some idea of the operating problems may be gained from the fact that about 800 ton an hour of hot catalyst must be raised nearly to the top of the 308 ft unit by a pressure imbalance principle using only 6 lb air pressure. In the catalyst regeneration process, water used to cool the material comes out as 450 psi steam —over 2,000,000 lb per day—which is used to supply steam power not only at the HCC unit but for most of Plant 5. In addition, 1,300,000 kwh of electrical energy is used at Plant 5 every month.

Operation of the plant is controlled from a room containing more than 240 instruments. Some of these are multiple point devices, and one enables the operator to dial some 500 points throughout the plant. Each point "called" returns temperature information and the number dialed to insure against wrong number. Radium with Geiger counters are employed for catalyst level.

THE WARM AND COLD TANK SYSTEM FOR MULTIPLE STATION COOLING

Here are advantages, layout and recommendations for the cooling system most often chosen to service a number of process units

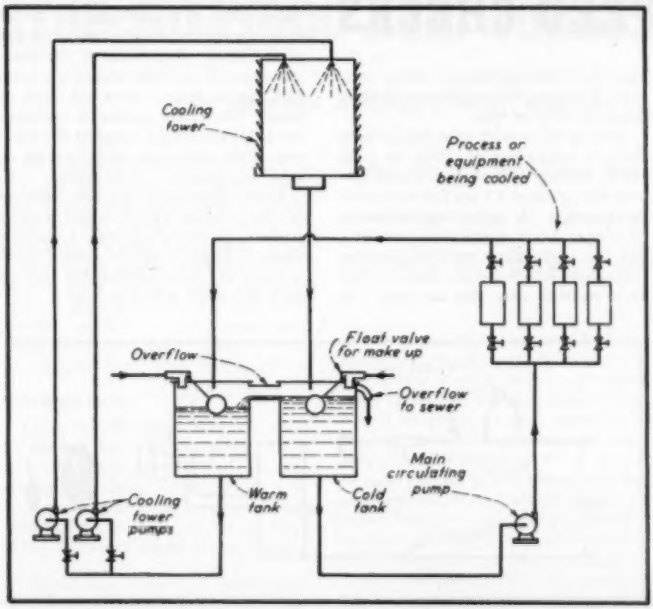
A. O. STACY, *Binks Manufacturing Company*

INDUSTRIAL water cooling is most commonly used in applications where one cooling tower services a multiplicity of separate units. Typical examples are die casting machines, plastic molding machines, resistance welders, quenching tanks using various quenching mediums, electric furnaces, linotype machines, rubber mills and rollers, paint and ink color mills, multiple refrigeration and air conditioning units, and many others. In general, almost every industry that uses heat in any form in any part of their processing also requires cooling water for which cooling towers can be used.

Normally the engineer is first interested in the system that has to be used to circulate the cooling water through the equipment from which the heat must be dissipated. Then he chooses a practical supply that can be depended on to provide adequate cooling for all loads—and in any weather.

The warm and cold tank cooling tower system has been found to be a most effective supply on a great majority of industrial jobs. Essential features are shown diagrammatically in the sketch.

In this system, cooling water is divided in two separate parts. The main supply pump takes water from the cold tank and circulates it through the process or equipment being cooled. The heated water is then dumped into the warm tank, from which it is pumped to the cooling tower, cooled, and allowed to flow by gravity back to the cold tank where it is again available for circulation through the process.



Warm tank receives heated water from the various process stations being cooled and supplies tower at a constant rate. Tower discharge to cold tank overflows to warm tank when not required by process. Overflow reverses with colder weather

The heat absorption water circuit and the heat dissipation, or cooling tower circuit, are completely separated. On many industrial jobs, this isolation is essential. With a multiplicity of units in the process, it is almost impossible to determine the average flow of water. For example, in a system servicing 100 or more plastic molding or die casting machines, water is used in intermittent cycles. The number of machines in operation at any one time varies considerably so that water requirements fluctuate between the widest limits. For this reason, pumping water directly through the equipment and then to the cooling tower is not feasible because the tower would have to handle a widely varying quantity. Best efficiency is obtained when the tower receives a constant and steady flow.

With the warm and cold tank system, the tower has a constant supply of water regardless of quantity being used in the equipment. When only a small part of the capacity is demanded by the process, the cooling tower pump can still operate at full volume because excess water from the tower flowing into the cold tank simply passes through the overflow connection into the warm tank, thereby balancing the system. The float valve on the warm tank makes up water loss due to evaporation and drift when the cold tank is full and its float valve is inoperative.

When the plant is operating at full capacity during summer months, cooling load is near maximum and water flowing through both process and cooling tower is about equal so that little or none overflows from either tank. This is the normal maximum operating condition.

If, during winter, the plant is operating at full capacity, water flowing through the equipment cooled is maximum. Because of outside temperature, however, sufficient cooling is obtained by circulating only a part of the water over the tower. Two pumps are shown in the drawing, but in this example only one of the pumps would be operating. The warm tank fills and overflows into the cold tank, tempering the cooling tower discharge which might otherwise be too cold. Since the warm tank is full and its float valve

inoperative, the valve on the cold tank will make up evaporation and drift.

On some jobs, this method has led to the use of several cooling tower pumps, each handling a proportionately small part of the flow. This allows a great variation in the quantity of water pumped over the cooling tower and corresponding flexibility in temperature control. Each pump has its own riser to, and manifold on, the tower and provides full cooling facilities at all times.

The main supply pump should be carefully selected, preferably from performance curves rather than performance tables. By referring to a curve, it is always easier to select a pump which has a wide range of capacity with but little change in head pressure. With care, a pump may be selected that has essentially no change in pressure while volume pumped changes from almost zero to 125 per cent or more of normal rated capacity. With the proper pump, water pressure to the process remains essentially constant regardless of how many units are in operation.

Capacity of the tanks should be as great as can be used conveniently. Minimum volume should at least be enough to flood the entire system and return water to the opposite tank before the supplying tank is drained. On average installations, this requires at least a capacity equal to the circulation per minute. For example, if the system is laid out for 400 gpm, both warm and cold tanks should each have at least 400 gal working capacity.

Where storage tanks are mounted above the floor, they are customarily made of steel and it is not always convenient to make them much larger. Where installation of concrete tanks (usually below the level of the floor) is possible, greatly increased capacity is recommended. Often they have a volume adequate for several hours circulation. The large tanks have the advantage of equalizing water temperature and allowing easier control of the temperature of water delivered to the process, a factor which may be important in many installations.

Size of warm and cold tank cooling systems is quite flexible. Installations have been recommended for factory-wide systems so large that tanks, cooling tower and pumps were housed in a separate building built for the purpose, and for the smallest applications handling as little as 10 gpm. The system is practical, foolproof and adapted to the widest range of applications.

What to do until the doctor comes

Emergency methods that may keep your equipment running after a breakdown until the permanent repairs are made

SIMPLE STROBOSCOPE FOR EMERGENCY SPEED CHECKS

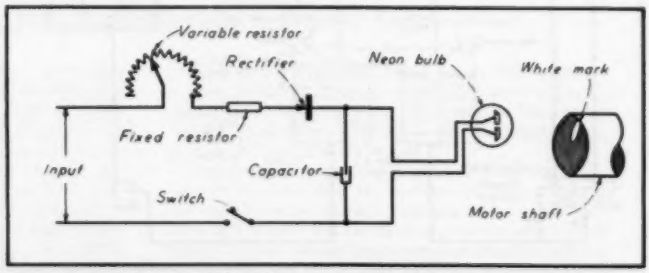
TACHOMETERS and revolution counters are seldom accurate enough for slip measurements and the more expensive types of stroboscopes are somewhat of a rarity in the average shop. Yet checking slip of an induction motor may give a more exact determination of speed for quickly locating conditions of overload, or defective operation such as caused by loose rotor bars. When actual speed is within 100 rpm of the synchronous value, the stroboscope shown in the diagram may be quickly assembled, "breadboard" fashion, from material on hand or easily obtained.

The source of power may be a lighting circuit of the same frequency of the motor supply. The capacitor, charged through the rectifier, discharges through the neon lamp to produce a flash of light illuminating a radial chalk mark made on the end of the motor shaft. The variable resistor allows adjustment of rate of capacitor recharge for a flash every positive half cycle or, with greater resistance, every second, third or more cycles. Because of rotor slip, the intermittant flashes will make the mark appear to revolve in a direction opposite to motor rotation. Counting revolutions of the mark gives the slip in rpm.

One to three watt neon lamps have built-in resistances of 5000 to 2000 ohms, making minimum desirable current rating about 15 ma for the circuit components. A radio type, selenium or copper oxide rectifier may be used, but the larger sizes may have inverse resistances which are too low. A tube type rectifier may also be used. In either case, it should be rated for the supply voltage.

Value of the capacitance may be one or more microfarads. Increasing the value produces more light, but over a longer period, tending to blur the image of the mark. Resistance of the rheostat depends on other circuit constants and may be several thousand ohms or more. The fixed resistor is optional, but helps extend the range of the rheostat. Both resistances will decrease in value as capacitance is increased.

Main drawback is the low intensity of illumination. The bulb and marked portion of the shaft will require a shade in brightly lighted areas. Use of a white or red high-visibility tape to mark the shaft will also help.



Quickly assembled stroboscope gives an accurate check when speed is within 100 rpm of synchronous value. Equipment is easily checked on a motor known to be operating normally. Longitudinal mark may be used when shaft end is covered

Materials for engineered plant services

Types and applications of materials that help in solution of problems involving corrosion, abrasion, heat and pressure

CONSTRUCTION MATERIALS THAT STOP SULFURIC ACID CORROSION--1

S. W. SHEPARD, *Materials Engineer, American Cyanamid Company*

Some recently developed organic materials are practically inert over wide range of sulfuric acid concentrations. With the right material in the right place, corrosion problems can be eliminated

A NUMBER of materials of construction with considerable resistance to sulfuric acid over a rather wide range of concentrations and temperatures can replace materials customarily used.

Most of the recent improvement has been in the field of organic materials such as plastics, elastomers and nonmetallic materials of construction. These have been used alone, and in combination with other materials.

Elastomers

Crude rubber linings have been used for many years to handle sulfuric acid at temperatures up to 150 F in concentrations ranging up to 50 per cent. They have also been used as a diaphragm behind acid resistant masonry to handle acid of higher concentrations and at higher temperatures. The Neoprene and butyl synthetic elastomers can handle slightly higher concentrations of sulfuric acid and at somewhat higher temperatures than natural rubber. Other similar materials that may be used by themselves or as a diaphragm behind acid resistant masonry are Pyroflex, Saran linings, Tygon or other vinyl linings and polyethylene applied as sheets or flame sprayed. These materials are also available as linings for pipes, liners for Saunders-type valves, as hose that can be used in pinch valves and in forms that can be applied to stacks, duct work, centrifuge baskets and other process equipment. Natural rubber and Neoprene are available as emulsions or dissolved in solvents so they may be applied as protective coatings along with an accelerator that will allow them to vulcanize at room temperature or slightly elevated temperatures. These linings have good adhesion and very good stability in the presence of dilute sulfuric acid.

Lead

Lead has been used for many years for these and similar applications. Lead is quite resistant to sulfuric acid at all concentrations up to around 90 per cent at room temperature and has good resistance at the boiling point of sul-

Abstracted from a report of the National Association of Corrosion Engineers Technical Practices Committee 5A of which Mr. Shepard is Chairman. He presented this report earlier this year at the N.A.C.E. Seventh Annual Conference, New York, N. Y.

furic acid to about 50 per cent. Its physical properties are poor. It is very heavy and has poor strength, particularly at elevated temperatures. It tends to fail by alligator cracking when stressed. This may be minimized by having the lead homogeneously bonded to steel, but this is an expensive process that requires much high skilled labor. The corrosion attack on lead is increased by some of the impurities commonly associated with sulfuric acid in the process industries, such as chlorides and nitric acid. Most of the organic materials that have been mentioned are not affected by chlorides or hydrochloric acid in the sulfuric. Some of them have fair resistance to small quantities of nitric acid that frequently occur in sulfuric acid.

Silicate Cements

For many years silicate cements have been used with acid resistant brick, with and without some of these diaphragm materials, to handle sulfuric acid. This cement is quite resistant to the higher concentrations of sulfuric acid but is attacked by dilute sulfuric and may be leached out when the equipment is washed or when it is idle and very dilute solutions may be present. This cement has been replaced to a considerable extent with the phenol-formaldehyde or furane based resinous cements. These cements are somewhat easier to apply, set up more rapidly, have better physical properties and are not leached out by dilute acid. However, they will not withstand elevated temperatures at very high acid concentrations successfully resisted by the silicates.

Furane Base Materials

There has been a considerable development in the last few years in the direction of using these cements, and particularly the furane base cements, in monolithic structures. The Maurice A. Knight Co. have developed a furane resin, which they call "Permanite," for pipe duct work, towers, pans, etc. The Haveg Co. have developed their furane resin, which they call "Haveg 60," reinforced with asbestos in reaction valves, tanks, pumps, valve bodies, pipe ducts, etc. These resins have also been used quite successfully when applied with alternate layers of glass cloth to cover steel and wood agitators, line wood tubs and many other similar applications where sulfuric acid is handled.

Phenol-Formaldehydes

The phenol-formaldehyde coatings, such as Heresite, have been widely used for lining steel equipment handling sulfuric acid in a wide range of concentrations. One of their most interesting uses has been as liners for storage tanks and tank cars handling battery acids or other acids that must not be contaminated with metal salts.

Protective coatings for structural steel adjacent to process equipment have been developed out of many of these organic materials and have been most successful. The resistance of these protective coatings to spills of sulfuric acid or intermittent contact with sulfuric acid is as dependent upon formulation, choice of pigments, plasticizer, solvents and application as on the particular resin used. Actual test exposure of the protective coating is the best guide in securing satisfactory information on the relative resistance of protective coatings.

Molded and Laminated Structures

Some of these resins have also been used in the molded and laminated condition for making tote boxes, fume hoods, filter plate press and frames and filter media for handling sulfuric acid solutions below about 30 per cent. Some of these resins, particularly the furane resins and polyester resins, have had novel uses as reinforcing agents for materials that have good resistance to sulfuric acid but are fragile. These resins are applied along with glass cloth as an armor over porcelain, quartz and graphite pipe, valves and tower members. This innovation has allowed the use of these materials where they might be subjected to mechanical shock, thermal shock or internal pressures where they formerly would not have been acceptable.

Field Connections Possible

There have been many improvements in the technique of handling these materials that has tended to make them more dependable than they were when they were first introduced. Among these improvements might be listed the use of Saran lined steel pipe and the techniques that have been developed for making good field connections. Polyethylene and some of the polyvinyl resins can be field-welded to make self-supporting structures that will withstand most dilute sulfuric acid conditions.

Wood has been impregnated with the phenol-formaldehyde and furfuryl alcohol type resins so that it is more resistant to sulfuric acid and has better physical properties for some purposes.

Polyfluorethylene

Teflon and other polyfluorethylene resins have made quite a place for themselves as valve components, gaskets and packing, handling acids of all strengths. Teflon has done a remarkable job as valve stem packing. The Alloy Steel Products Co. has also been making valve plug inserts and seats of Teflon. The Duriron Co. has developed a real improvement in plug cocks through the use of a Teflon shroud that fits over the plug separating the Durimet 20 plug from the Durimet 20 body, acting as a lubricant. American Cyanamid Co. has had valves in strong sulfuric acid service for about eight months that are still functioning very well. It is possible that this device might also make cast iron plug cocks more acceptable for sulfuric acid service.

Fiber Conduit

For handling 10 to 15 per cent sulfuric acid solutions at temperatures up to 130 F, Orangeburg fiber and Bermico fiber conduit have proved quite successful in effluent disposal lines. These are made of asphalt and wood fiber composite. It is quite economical, easy to lay and has proved itself for many years in all kinds of soil conditions.

Other non-metallic materials of construction successfully used are carbon or graphite, glass, porcelain or stoneware. These materials have been made into a wide variety of process equipment such as pipes, pumps, reaction vessels, towers, etc. and have outstanding resistance to acids other than hydrofluoric over a wide range of temperatures. Glass-lined steel equipment has been used in many acid processes such as sulfonations, chlorinations, etc.

Vinyl Filter Media

One of the vinyl resins in fiber form has been used for filter media in handling sulfuric acid solutions quite successfully. Saran and Fiber A have also been used with some success as filter media for sulfuric acid.

Some of the silicone resins have considerable resistance to sulfuric acid. Silastic 180 and 181 have good resistance to sulfuric acid up to 30 per cent and temperatures as high as 100 C. They are not resistant to concentrated sulfuric acid, even at room temperatures.

Uscolite, a thermoplastic of the U. S. Rubber Co., has shown good physical properties and good resistance to sulfuric acid in concentrations up to 25 per cent at room temperature.

For some specialty items, such as porous filter media, alundum has stood up very well.

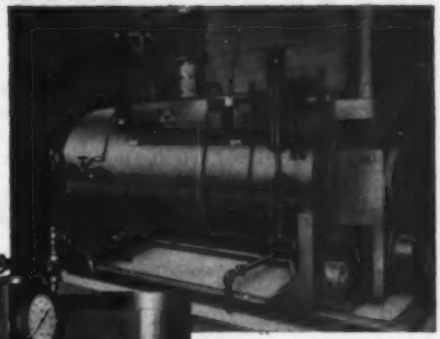
Part 2 of this article, which will discuss metallic materials of construction for handling sulfuric acid, will appear in our December issue.

You can Save on Steam

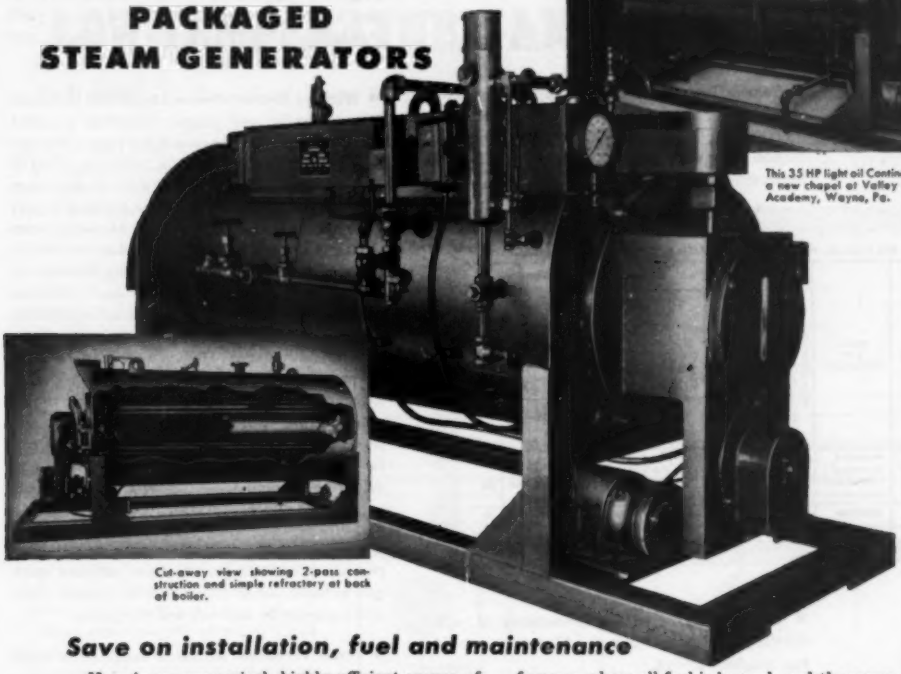
with highly efficient

Continental

PACKAGED STEAM GENERATORS



This 35 HP light oil Continental unit heats a new chapel at Valley Forge Military Academy, Wayne, Pa.



Cut-away view showing 2-pass construction and simple refractory at back of boiler.

Save on installation, fuel and maintenance

Here is an economical, highly efficient source of steam for heat or processing. The Continental Packaged Steam Generator guarantees you at least 80% efficiency, with steam moisture content under 1%—by actual independent tests. Simplified design of the unit, based on 40 years' boiler engineering experience, assures dependable, low-maintenance service year after year.

The Continental is an improved type 2-pass boiler, using the widely successful principle applied in Scotch Marine Type boilers. Unlike more complicated 3- and 4-pass boilers, it can be opened front and back in 15-20 minutes, permitting easy access for cleaning and maintenance. The construction also eliminates excess refractory. Water fully surrounds the boiler furnace, where all fuel is burned, and the gases pass spirally through 3" tubes, resulting in maximum heat transfer, low flue gas temperature, and high efficiency.

The Continental Packaged Steam Generator is equipped with dependable controls of finest quality for fully automatic operation. The burner, specially designed for the boiler, is available for heavy oil, light oil, gas, or a combination. Ready for operation after simple service connections. Generator sizes range from 10 to 500 HP, for high and low pressure.

Before deciding on equipment to meet your specific needs, be sure to compare the Continental cost-saving features. We'll gladly send you details. Clip and mail the coupon today.

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MONEL { *A general-purpose, corrosion-resisting alloy for applications that require a hard, tough, high-strength material*

Monel® is a solid-solution alloy which combines high strength, ductility, fatigue strength, and toughness, with excellent resistance to corrosion. Its properties can be changed by cold working but it cannot be age hardened. It is slightly magnetic at room temperature and is non-magnetic above 110°-140°F.

The principal mechanical properties of Monel are:

● **Tensile Properties:** Hot-rolled Monel has a *minimum* yield strength (0.2% offset) of 25,000 psi., a minimum tensile strength of 70,000 psi., with an elongation (in 2 in.) of approximately 45%.

MECHANICAL PROPERTIES AND PHYSICAL CONSTANTS OF MONEL

MATERIAL	FORM AND CONDITION	AVERAGE MECHANICAL PROPERTIES				AVERAGE PHYSICAL CONSTANTS								
		YIELD STRENGTH (0.2% offset) 1000 psi.	TENSILE STRENGTH 1000 psi.	Elongation in 2 in., per cent	HARDNESS BRINELL	DENSITY lb./cu. in.	SPECIFIC GRAVITY	MELTING POINT °F.	Specific heat (32°-212°F.) Btu./lb./°F.	Thermal Expansion Coefficient (32°-212°F.) 10⁻⁶ in./in./°F.	Thermal Conductivity (32°-212°F.) Btu./sq. ft./hr./°F./in.	Electrical Resistivity (72°F.) microhm-cm.	Tensile Modulus of Elasticity 10⁶ psi.
Monel (wrought)	Annealed	35	75	40	125	0.319	8.84	2370-2460	0.13	7.8	180	290	26
	Hot-rolled	80	90	35	150								
	Cold-drawn	80	100	25	190								
	Cold-rolled	100	110	5	240								
Monel (cast)	Sand-cast	35	80	35	135	0.312	8.63	2400-2450	0.13	6.8	180	330	19

● **Toughness:** Due to the coexistence of high ductility and high strength, Monel is one of the toughest alloys.

Charpy impact valves vary from 220 ft.-lb. for hot-rolled Monel, to 150 ft.-lb. for cold-drawn.

● **Spring Properties:** Monel spring wire can be used under corrosive conditions and at temperatures up to 400°F. For wire sizes heavier than 0.057-in. diameter, design of springs is based on a torsional modulus of 9,500,000 psi. and stresses of 45,000 psi. for average service, and 35,000 psi. for severe service.

● **Endurance Limit:** In rotating beam tests of polished specimens at room temperature and 10,000 r.p.m., Monel (cold-drawn, as-drawn) showed an endurance limit for 10^8 cycles of 40,000-47,750 psi.

● **Low-Temperature Properties:** Monel has excellent properties at sub-zero temperatures. Data shows that strength increases, without appreciable change in ductility, hardness or impact strength. Cold-drawn Monel at −110°F. had a tensile strength of 117,450 psi., a yield strength of (0.20% offset) of 100,850 psi., and charpy impact strength of 178 ft.-lb.

● **Working Characteristics:** Monel can be forged in practically any shape forgeable in steel. Recommended temperature for heavy-hammer forging and drop forging is 2150° to 1700°F. Hot working should be avoided in the range of 1700° to 1200°F. (If it is unavoidable, only light hot work should be done.) Monel behaves similarly to mild steel in mechanical cold working, as in cupping, drawing, swaging, die-forging, power hammering, bending and forming. Monel's high strength limits manual operations, such as spinning, bumping, and hand hammering, to easy shapes. Heavy work can be done by hand only with frequent anneals. Monel is satisfactorily machinable but due to its toughness, cutting speeds are somewhat slower and feeds lighter than those for mild steels. It can be joined by the usual welding, brazing, and soldering processes.

● **Corrosion Resistance:** Monel is highly resistant to attack by most commonly encountered corrosives, including neutral and alkaline salts, salt water, mineral acids, alkalies, organic acids and compounds, and wet and dry gases.

● **Forms Produced:** Monel is supplied in most commonly used mill forms—rods, hexagons, squares, rounds, flats, strip, sheet, seamless tubing, wire, welding materials—and in a variety of finishes and conditions. It is also produced in sand, centrifugal and precision casting.

FOR ADDITIONAL DATA

Write for your free copy of Technical Bulletin T-5, "Engineering Properties of Monel and 'R' Monel." It contains all essential engineering information on these alloys.

Nickel alloys are being increasingly diverted to defense applications. However, technical help for metal problems involving corrosion, high temperatures or fatigue is available from Inco's Technical Service, either for immediate defense needs or for future installations.

INCO **Nickel Alloys**

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Handbook for engineered plant services

Methods, data and ideas that make excellent references in solving engineering problems frequently encountered in plant operations

LOW-TEMPERATURE AMMONIA SYSTEMS

O. B. WERT, *Air Conditioning and Refrigeration Section, Worthington Pump & Machinery Corp.*

ADAPTATION of existing ammonia systems, to low-temperature service, with special attention to liquid and gas cooling, is covered in this article.

Recently there has been a great deal of literature written about Freon-12 and Freon-22 multistage reciprocating systems for low-temperature applications, but very little information has been disseminated concerning ammonia systems. It is also the purpose of this article to help fill this void.

While Freon applications usually require completely new systems, existing ammonia systems can readily be adapted—at minimum expense—to two or three stage operation for low temperature. This can be done by the addition of a booster compressor or compressors and shells for gas and liquid cooling, provided the existing high stage compressor motor and refrigerant condenser are large enough for the increased suction pressure which will occur.

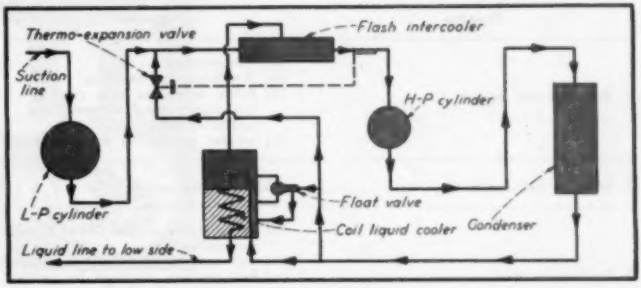
It is true that ammonia systems require larger volumes of gas than do Freon systems, but they are simpler and less costly to operate and maintain. Evaporating temperatures as low as minus 90 F can be attained.

We list some general rules to follow in adapting an existing system to low temperature:

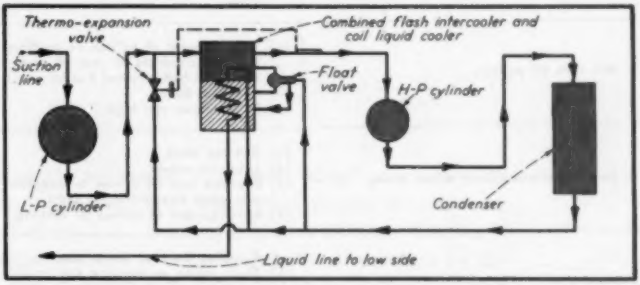
1. If the system is large enough, an ammonia pump can be used to circulate the refrigerant through the coils or evaporator to eliminate the static-head penalty.

2. A suction-gas-heat exchanger is required prior to the low-pressure stage to warm the suction gas to minus 40 F thereby insuring proper lubrication of the compressor. This heat exchanger does not benefit compressor displacement as it does in Freon systems. As with any low-temperature system, pressure drop should be at a minimum.

3. If a large system is involved, liquid sub-coolers and/or gas intercoolers should be furnished between the various stages of compression. For smaller plants, the use of desuperheaters or gas intercoolers only may be indicated, the desuperheater lowering the intermediate temperature to within 15 F of the saturation temperature at that pressure. These precautions are taken to limit discharge temperature of the high stage to about 300 F.



Flash intercooler with coil liquid cooler adapted to low-temperature service



In this arrangement, flash intercooler and coil liquid cooler are combined

The types of liquid coolers and desuperheaters most commonly used by Worthington are designated as No. 7 and No. 9, sketches of which are shown in the accompanying illustrations. No. 9 has both features embodied in one shell, while No. 7 uses two shells so that liquid cooling can be omitted if desired.

Liquid coolers for ammonia are nearly always of the flooded-coil type, fed by means of a low-side control or a float switch and magnetic liquid stop valve. Hand expansion by-pass valves should be used around these coolers.

Coil-type liquid coolers should always be used to insure sufficient pressure to get the liquid from the condenser to the evaporator without resorting to liquid pumps, large line sizes, or large evaporator feed valves.

Handbook for engineered plant services

Methods, data and ideas that make excellent references in solving engineering problems frequently encountered in plant operations

Troubleshooter Table for . . . .

FLAT LEATHER TRANSMISSION BELTS

Trouble	Cause	Remedy
1. Belt slips and squeals	(a) Belt too loose. (b) Insufficient belt capacity. (c) Pulley crown too high, causing increased wear of narrow center section of belt. (d) Leather surface too dry and shiny.	(a) Increase belt tension. (b) Use thicker or wider belt. (c) Decrease crown taper to 1/8 in. per ft. (d) Apply suitable dressing.
2. Excessive belt stretch	Belt capacity too low.	Use thicker or wider belt.
3. Belt runs crooked	(a) Belt stretched on one side by forcing over pulley. (b) Belt ends not squared when joining. (c) Belt unevenly stretched by running on misaligned pulleys. (d) Loose belt unevenly stretched by running up on flanged or step-cone pulley.	(a, b, c and d) Repair damaged belt section or replace belt. Eliminate physical cause when installing.
4. Belt runs off pulleys	(a) Misalignment of pulleys or shafting (if belt continues to run off same side when belt is turned end for end.) (b) Crooked belt. (c) Pulley crown too high.	(a) Eliminate cause. (b) Repair belt. (c) Decrease crown taper to 1/8 in. per ft.
5. Belt runs to one side of driven pulley	(a) Belt too slack. (b) Load too great. (c) Crooked belt (if it runs to opposite side when turned end for end.) (d) Misalignment of pulleys or shafting.	(a) Increase belt tension. (b) Use thicker or wider belt. (c) Repair belt. (d) Eliminate cause.
6. Belt whips and flaps	(a) Pulsating load or power source. (b) Shaft, motor, or machine not rigidly supported. (c) Lopsided pulley. (d) Bent shaft. (e) Too much or too little belt tension.	(a, b, c, d and e) Eliminate cause where possible. Try change of speed or addition of flywheel to smooth out the load.
7. Belt weaves back and forth across pulley	(a) Wobbly pulley. (b) High spot on pulley. (c) Belt extremely crooked.	(a and b) Correct faulty condition. (c) Repair or replace belt.
8. Cracked outside ply	(a) Excessive belt tension. (b) Pulley diameter too small.	(a) Reduce tension. (b) Provide proper pulley for belt thickness.
9. Cracked inside ply	Burning caused by excessive slip.	See Item No. 1.
10. Peeling grain	(a) Excessive slip. (b) Improper belt dressing. (c) Chemical fumes or oil.	(a) See Item No. 1. (b) Clean belt with commercial solvent, scrape off any loose grain, and use suitable dressing. (c) Provide guards if possible, and use type of belt best suited for condition.

Courtesy of The American Leather Belting Association.

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Spot news

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Installed Electric Generating Capacity Expected to Total 140 Million Kw by 1961

From 1920 to 1951 installed generating capacity increased from about 13 million kw to 75 million kw. In the same period, generated kwh increased from 40 to 360 billion. By 1961, it is expected that the installed generating capacity will reach 140 million kw, and the annual rate of generation at over 600 billion kwh.

A. A. Johnson, Manager of Central Station Engineering for the Westinghouse Electric Corp., attributes this tremendous growth to (1) public recognition and appreciation of the benefits derived from increased use of electricity, (2) population growth, the national preparedness effort, (3) arming of other nations in many parts of the world, (4) continued business as usual at home, and (5) the supplying of food products to other nations who are in dire need.

Some of the factors that will make this growth in the electrical industry possible are technological improvements in both steam and gas turbines, and the possible utilization of atomic power in the generation of electric power. Advancements in design of generators, transformers, switchgear and other equipment will contribute toward the goal.

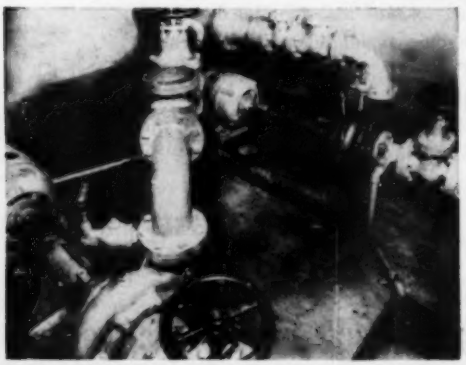
Bladeless Trash Pumps Cure Serious Headache At Trouble Spot in Baltimore Sewage System

Two of the first Fairbanks-Morse bladeless trash pumps to go into regular service in the field have solved a difficult sewage handling problem for the Joppa Road Pumping Station at Towson, Md. in Baltimore County Metropolitan District. They have converted a trouble spot that required servicing every day in the year into a completely automatic pumping station.

The Joppa station, with a capacity of 500,000 gpd, gathers sewage from a broad area and pumps it down the main line to a treatment plant. Most of the area served is residential but two factors make Joppa the headache of the system. First, five industrial plants discharge a variety of difficult waste products into the line. Second, and most important, a nearby hospital sends through the pumps a large volume of rags, towels, bandages and cotton. Actually, a high percentage of the sewage handled by this station is the kind of fibrous solid that clings to impeller blades and clogs pumps.

The new bladeless horizontal trash pumps were installed on January 12, 1950, and have been in continuous operation ever since. Not only does the same type of sewage pass through the station but the quantity has increased greatly in the past year.

At this writing, each of the two pumps has been in service nearly 14,000 hours without clogging. As compared with station experience with the old pumps, this has meant the elimination of more than 1,000 service calls.



Bladeless horizontal trash pumps operating in sewage system have already given 14,000 hr clog-free service

Test Run Yields More Than 10 Million Cu Ft Of Gas From Lignite

About 10,000,000 cu ft of potential industrial gas were produced from lignite during the 18th experimental run recently completed in the Federal Bureau of Mines pilot plant of the Department of the Interior at Grand Forks, N.D. The test run, longest to date, was voluntarily shut down after 947 hr of successful operation. Conducted under the supervision of Walter H. Oppelt, chief of the Bureau's Region V Utilization Section, the run used 438,415 lb of lignite donated by six mining companies located in North Dakota and Saskatchewan, Canada. Railways provided free transportation of the lignite to the plant.

About 85 million cu ft of gas have been produced during the 18 test runs that have been made since the pilot plant began operating in 1945. The gas, which may provide a way to make greater use of the Nation's 355,725,000,000 ton of recoverable lignite reserves, could be used in pro-

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Search your plants and properties for dormant scrap, such as obsolete machinery, tools, jigs, dies, fixtures and other equipment, including items that are broken, worn beyond repair, abandoned, or in need of parts that can no longer be obtained. Sell it to your local scrap dealer who will pay established prices for your dormant scrap and will prepare it to the exact specifications of the consuming mills and foundries where it is desperately needed for current steel production.

Contact your U. S. Department of Commerce field office for more information on *Scrap For Steel For Defense!*

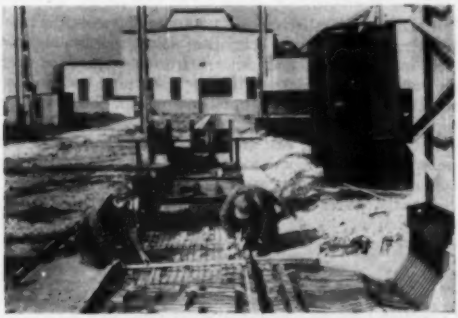
ducing synthetic liquid fuels, reducing Minnesota iron ore, manufacturing ammonia for fertilizer for agricultural use, and for the hydrogenation of vegetable oils and fats.

During gasification, lignite is fed into the top of an 18 ft long circular retort made of chromium nickel alloy, heat applied to the retort, steam introduced with lignite and water gas produced. Often called blue gas because of its blue flame, it is chiefly hydrogen and carbon monoxide.

Heating Cable Keeps Runways Free of Snow And Ice at Bucyrus-Erie Factory

Concrete crane and transport runways are being kept clear of snow and ice by a novel application of heating cable at the South Milwaukee plant of the Bucyrus-Erie Co. The runways were lined with General Electric flexible lead-covered heating cable just before the worst part of the winter last year. The installation, comprising 40,000 ft of heating cable, covers four concrete runways ranging from 100 to 275 ft long and about 10 ft wide.

Step-down transformers supplying correct voltage for the non-standard lengths of heating cable were built especially



More than 40,000 ft of heating cable were laid under this transport runway to keep it clear of snow and ice

for this installation by G. E.'s Milwaukee service shop. Required secondary voltage is about 180 v for the shortest runway and about 500 v for the longest.

The heating cable is laid on wire mats about 2.5 to 3 in. below the surface and on approximately 3 in. centers. Tile drains installed along the edges of the runways provide adequate drainage for the melted snow.

According to Bucyrus-Erie officials, the heating cable met its greatest test to date last winter after a weekend snowfall. Even with the outside temperature at 11 F below zero, the cable was able to clear the runways in a few hours.

Pacific Gas to Build $80 Million Power Plant in California

Pacific Gas & Electric Co. announced a decision to construct its 10th postwar plant, a steam plant to contain four 150,000 kw generating units and to cost $80 million. It will be located on the south shore of the San Joaquin River, west of Pittsburg and seven miles downstream from its new Contra Costa steam plant which was dedicated last month. The new plant will be the biggest in California, according

(Continued on page 108)

BH therm-enomics*

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The Black Rockwool Insulation

Baldwin-Hill's Mono-Block features these outstanding properties in answer to your problems of industrial heat control:

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- Lower cost installed
- Felted layer construction
- Light, resilient
- Cuts easily
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If you have a problem of heat loss, consult Baldwin-Hill on the best type of insulation to use—and how to use it. THERM-ENOMICS* service is backed by a *complete* line of *Black* Rockwool insulating materials . . . block, blanket, cements, etc.

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- ☐ Mono-Block—for temperatures to 1700°F
- ☐ Blankets—metal reinforced, large-area coverage to 1200°F
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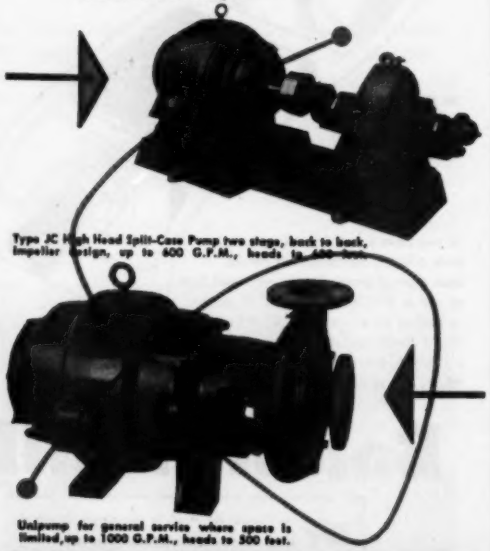
Extensive experience with all kinds of pumping applications makes any advice from a **WEINMAN** representative sound advice. He is backed by an organization which devotes its entire skill to the continuous improvement of one product—pumps. His head and his briefcase are crammed with ideas and engineering data on how liquids can be handled most effectively. This data plus common sense gained through experience can be applied to your problem to get the results you need. Plan to talk over your pump problems with a specialist — just write, wire or phone **WEINMAN**, Career Men in Pumps.



Type JC High Head Split-Case Pump two stage, back to back, impeller design, up to 600 G.P.M., heads to 600 feet.

Unipump for general service where space is limited, up to 1000 G.P.M., heads to 500 feet.

Built by Centrifugal Specialists

The **WEINMAN** Pump Mfg. Co.

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REPRESENTATIVES IN PRINCIPAL CITIES

Spot news

(Continued from page 107)

to James B. Black, president. Each of the four generators will be larger than any other on the P. G. & E. system.

Announcement of the 600,000 kw project was made as the deed was recorded to a 230 acre site between the river and the Sacramento Northern Railway line just west of Pittsburg in Contra Costa county. The plant will be 150,000 kw larger in capacity than the combined Shasta and Keswick power installations of California's Central Valley project.

Plastic Pipe Resists Chemical Action of Corrosive Mine Waters

Rigid plastic pipe of 8 in. diam and 180 ft long has been installed in a new bore hole at the Wilkes-Barre, Pa. mine of the Lehigh Valley Coal Co. to transmit mine water from a pump to the surface at the rate of 800 gpm. Static head pressure is 80 psi.

Because of the characteristics of its components, the plastic pipe resists the chemical action of sulphurous waters, alkalies, metallic salts, and other corrosive wastes frequently encountered in mines. While metallic pipe lasted only a short time in this type of bore hole installation, the plastic pipe is expected to give many years of service, since it is effectve against rot, rust and electrolytic corrosion. Smooth internal surface minimized frictional loss and will not accumulate scale, thereby assuring maximum flow rate.

Installation of 180 ft of plastic pipe in the bore hole was completed in 5 hr; 21 ft sections of pipe were connected by cemented slip sleeve fittings.

Nebraska Town Installs State's First 100 Per Cent Dual-Fuel Diesel-Generator

Wilber, Neb., has completely rebuilt its power distribution system. Ultra-modern mercury-vapor street lights were installed with underground cables to serve them. The old building which housed the steam plant was remodeled to accommodate the three dual-fuel engines and all accessory equipment.

The engines chosen are trim enbloc units which operate on the efficient diesel cycles but burn economical natural

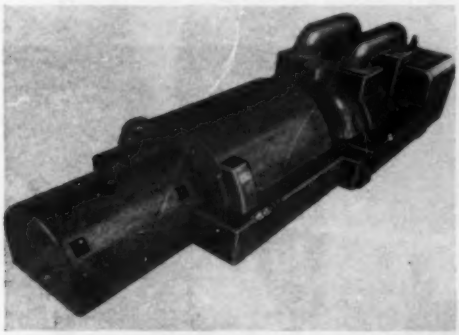
These three dual-fuel diesels with total rating of 1105 hp supply power requirements at Wilber, Neb.

gas with a small quantity of oil as pilot fuel. In the event of gas supply failure, the units switch automatically to oil. These two-cycle Fairbanks-Morse engines have 8½ in. bore, 11 in. stroke and develop rated horsepower at 514 rpm. One is a seven-cylinder unit, rated at 455 hp, and drives a 310 kw, 2400 v Fairbanks-Morse alternator. The other two are five-cylinder 325 hp engines; they drive 220 kw F-M alternators. The engines are served by a full complement of modern accessory equipment.

Though the plant has only a brief operating record, it already has demonstrated its capacity to fulfill Wilber's objectives. Engine efficiency is such that Wilber is saving at the rate of more than $8,000.00 a year as compared with the cost of purchased power. This takes into consideration all plant costs including interest and depreciation. In the first five months, the engines generated 610,290 kwhr and burned 7,816,000 cu ft of natural gas and 7,990 gal of pilot oil. Average fuel cost was just 4.1 mills per kwhr. This has been achieved with fuel oil costing from 9.6 to 11 cents a gal, and gas ranging from 21 to 23.4 cents per thousand cubic feet.

World's First "Supercharged" Generator Installed by Wisconsin Power and Light Company

Allis-Chalmers has announced the installation of the world's first "supercharged" generator at the Edgewater plant of the Wisconsin Power and Light Company in Sheboygan, Wis. This new design rated 60,000 kw, 12,500 v, 3600 rpm steam turbine driven generator was installed in



World's first "supercharged" generator installed at W.P.&L. Edgewater plant. It embodies a new principle for cooling rotor coils that saves up to 40 per cent of materials now required to build a 60,000 kw machine

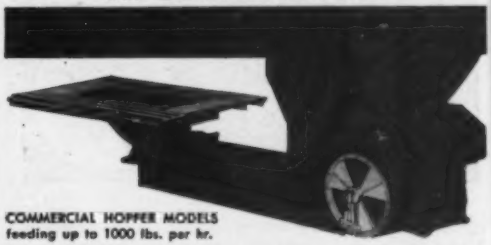
mid-summer and is now in operation. It embodies a new principle which saves 30 to 40 per cent of the material of a normal 60,000 kw machine.

The great reduction in weight and length is achieved by forcing hydrogen at much higher velocity than has been used before, directly over the surfaces of the current-carrying copper conductors of the rotor. In addition to the normal fans for circulating the hydrogen, the new generator has a two-stage centrifugal compressor mounted at one end of the rotor shaft supplying gas to the rotor. To get the heat out of the rotor faster, engineers have devised specially shaped copper windings through which cool hydrogen travels at high speed. After being heated in passing through

(Continued on page 158)

Combustioneer

FOR HIGHER HEAT EFFICIENCY AT LOWER COSTS



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Factories, plants, shops, stores, theaters, hotels, apartment houses, other large private and public buildings . . . all use *big quantities* of heat, hot water or steam . . . all can show *staggering fuel costs!*

Yet you can cut those costs . . . cut them up to 30% . . . with Combustioneer Automatic Coal Stokers. Think of that saving . . . monthly . . . or *yearly!*

Combustioneer gets *all* the heat *out* of the coal. Its exclusive "Pulsating" Transmission, Automatic Respirator and "Breathing" Fire-Bed assure highest efficiency combustion under all conditions and provide perfectly controlled automatic heat. And Combustioneer's extremely rugged design and construction pay off in long-lived dependability and lowest maintenance cost.

Hopper and bin-feed models, capacities up to 1000 lbs. per hr. Write us today for further information about how Combustioneer is saving money in your specific kind of business and can save money for *you.*

THE STEEL PRODUCTS ENGINEERING CO.
1305 W. Columbia St., Springfield, Ohio

Please send us, without obligation, further information about your commercial models of Combustioneer, and information about your free heating analysis.

NAME_____

KIND OF BUSINESS_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Practical Ideas

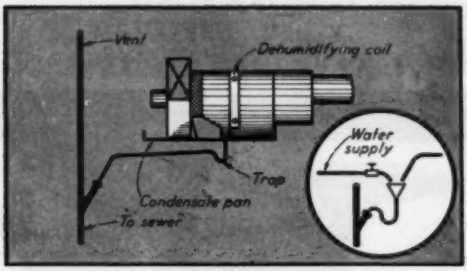
Kinks . . . . . How To's

Improvised short cuts that are practical solutions to your operating and maintenance problems. We pay $10 on acceptance of each idea

Odors Removed from Conditioned Air Supply

Odors contaminating the air supply from the conditioning system serving one of our plant offices were found to come from a sewer into which a trapped drain line was connected as shown in the accompanying drawing.

Upon close examination, the trap was found to be ineffective because of the lack of moisture in the U section. Markings on the sheetmetal casings indicated a deeper coil at one time had been used. The present coil showed no tendency to remove moisture in great quantities and the pan was practically dry. The trap being on the suction side of the fan was permitting sewer gases to be drawn into the air stream.



Problem was solved when the direct tie-in to the vent was broken and the drain run into a funnel receptacle as shown in the circled drawing. Water supply was always available to replenish the seal.

John D. Constance, Cliffside Park, N. J.

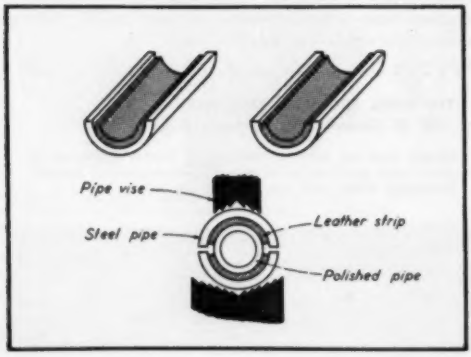
Improvised Polished-Pipe Vise

We wanted to cut and thread some polished chrome-plated pipe without scratching or marring it, and were unable to get a polished-pipe vise immediately. We therefore had to improvise something for the job.

For holding ½ in. polished pipe, we took a piece of 1 in. steel pipe about 4 in. long, sawed it in half lengthwise, and lined the halves with strips of leather. We then sprinkled powdered rosin on the leather, and used it with a regular pipe vise as illustrated in the drawing. The device worked perfectly.

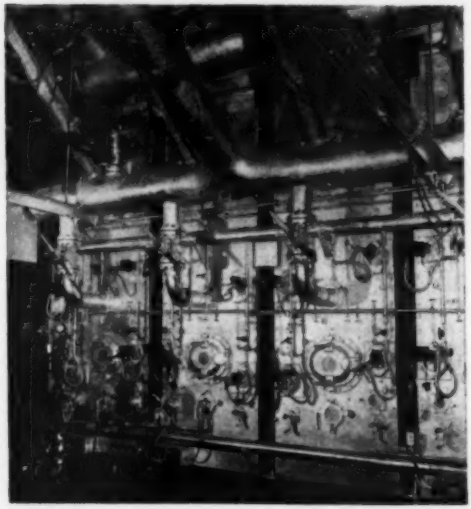
For holding ¾ in. polished pipe, we used 1¼ in. steel pipe. For holding 1 in. polished pipe, we used 1½ in. steel pipe.

Arthur Holt, Atlantic City, N. J.



Insulated Burner Lines Cut Gas Shriek

Insulation on gas lines feeding burners at the Long Island Lighting Company's Glenwood Landing power station has considerably improved personnel comfort and efficiency by reducing the piercing shriek of fast-flowing natural gas to a soft murmur inaudible above normal plant noises. Although mineral wool's primary job at the 170,000 kw plant is to cut heat loss from high temperature equipment, reduction of noise level in working areas adjacent to the burners is the only function of insulation on the overhead gas lines.



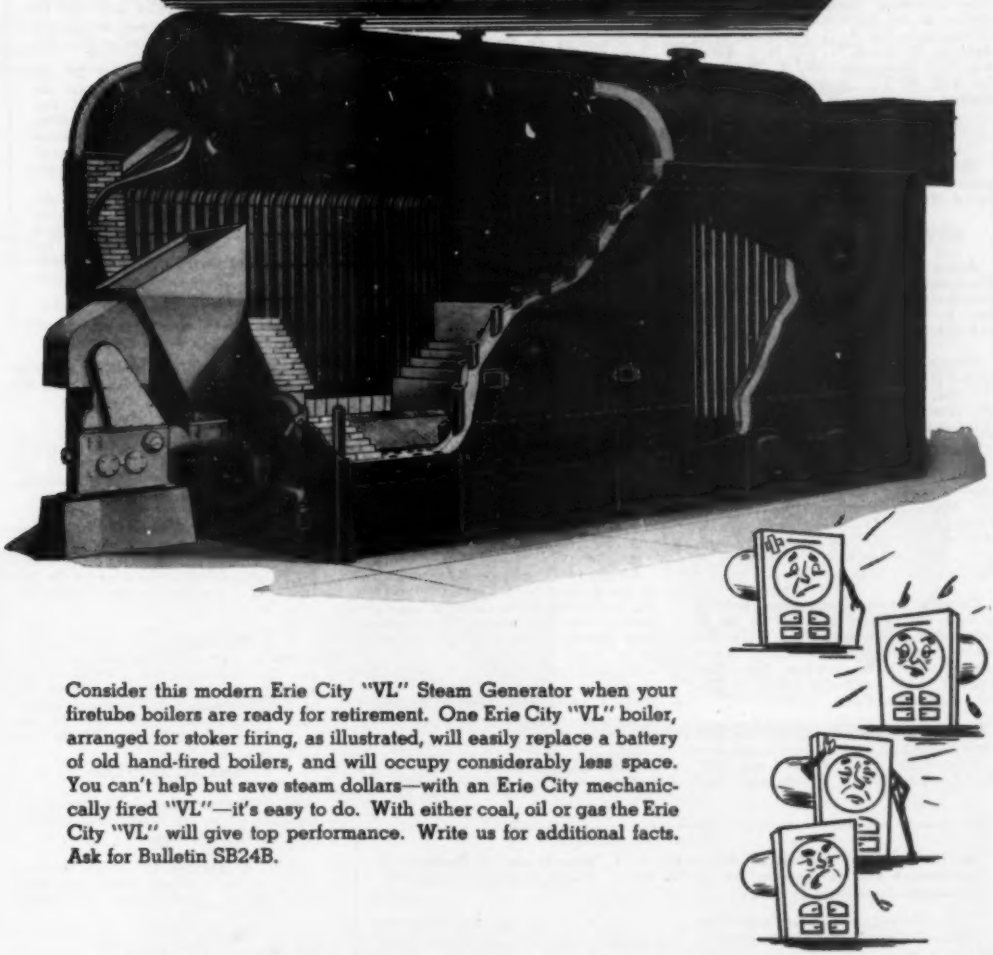
In the illustration, the T-shaped pipe section above the burners of Glenwood's No. 4 boiler supplies incoming natural gas at a temperature of about 30 F. Four small pipe sections connect the large gas line to burners.

Courtesy of Industrial Mineral Wool Institute

Formula for Saving Steam Dollars

300 h. p. (rated) ERIE CITY VL Boiler - Stoker unit

Factory Assembled!



Consider this modern Erie City "VL" Steam Generator when your firetube boilers are ready for retirement. One Erie City "VL" boiler, arranged for stoker firing, as illustrated, will easily replace a battery of old hand-fired boilers, and will occupy considerably less space. You can't help but save steam dollars—with an Erie City mechanically fired "VL"—it's easy to do. With either coal, oil or gas the Erie City "VL" will give top performance. Write us for additional facts. Ask for Bulletin SB24B.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Types VL & VC 2-Drum Boilers • "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • "Keystone" Packaged Steam Generators • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

News
of men and companies

SOCIETIES

Instrument Society of America — The following national officers were elected at the Sixth Annual Instrument Conference: Dr. A. O. Beckman, president, D. M. Boyd, Jr., v-p, R. T. Sheen, v-p. Still incumbent: W. A. Wildhack, 1st v-p, N. L. Isenhour, v-p, G. R. Feeley, treas. and R. Rimbach, sec.

ANNIVERSARIES

Hendrick Mfg. Co.—Folder commemorating 75th anniversary now being distributed.

NEW REPRESENTATIVES

Arcos Corp.—Clements Welding & Machinery Co., 700 Hawk Ave., are distributors for the St. Louis territory and R. & R. Welding Supply Co., 315-12th St. covers the Des Moines area.

Hanna Engineering Works—Sweetland-Affleck Corp. with offices at 940 N. Fair Oaks, Pasadena, and 405 Mo tgomery St., San Francisco appointed dealer for Central and Southern Calif.

Metals Disintegrating Co., Inc.—The appointment of the Truesdale Co., Boston, Mass. as distributors in the New England area is announced. A. C. Mueller Co., 1213 W. 3rd St., Cleveland, Ohio, named representatives in the Cleveland area.

Termite Drills, Inc.—After moving to new and larger quarters at 99 N. Lotus Ave., Pasadena, Calif., the following sales representatives were named: Clark & Sawyer, Inc., Los Angeles, Calif., and the Specialty Co., Inc., Lakeville, Conn.

Wilmot Engineering Co.—The following district sales representatives have been appointed: H. C. Lusk, 3045 W. Liberty Ave., Pittsburgh, Pa.: Cross Pump & Equipment Co., P. O. Box 889, Charleston, W. Va.; Crowell Engineering & Sales Co., 3045 Sutherland Ave., Knoxville, Tenn.; J. Van Horn, 1139 Claytonia Terrace, St. Louis, Mo.; A. A. Culp, 930 Second Ave. N., Birmingham, Ala. and International Mfg. & Equipment Co., 220 Broadway, New York.

L. J. Wing Mfg. Co. — The Stone Co. of Rochester, N. Y., has been appointed to handle the complete line in western New York.

HONORS

Combustion Engineering - Superheater, Inc.—A. R. Mumford, research engineer, received the Percy Nicholls' Award at the Fourteenth Annual Joint Fuels Conference sponsored by the Fuels Div. of the ASME and the Coal Div. of the AIME. The citation for award recognized Mr. Mumford's contribution to important advances in utilization of fuels through his research work on the combustion of coal, heat transfer, and circulation in steam generators.

A. R. Mumford

American Standards Association — In recognition of a lifetime of service and leadership in the cause of standardization, the first award of an annual gold Standards Medal has been made to Dr. Paul G. Agnew.

Ex-president Herbert Hoover has been awarded the Howard Coonley Medal for long and outstanding service in advancing economy through voluntary standards.

Westinghouse Electric Corp.—W. L. Roberts of the research laboratories has won the annual $750 award made by the American Welding Society for the best paper on resistance welding.

Dearborn Chemical Co.—G. R. Carr, chairman of the board, was honored at the company's annual dinner for the completion of a half century of continuous service to the company.

Electrochemical Society — The first Palladium Medal award was presented to Dr. Carl Wagner, M.I.T. professor, for "outstanding achievements in the study of corrosion of metals and its control."

U. S. Rubber Co.—G. R. Vila, general sales mgr. of the Naugatuck Chemical div., has received a certificate of appreciation from the U. S. Army for his services with the Technical Industrial Intelligence Committee of the Joint Chiefs of Staff during World War II.

SALES OFFICES

Iron Fireman Corp.—The southern regional office, 60 Haas-Howell bldg., Atlanta, Ga., is reopened.

Johnson Service Co.—New branch office opened in South Bend, Ind., with A. J. Hunter, sales engineer, in charge.

Link-Belt Co.—Factory branch store and sales office opened at 108 S. 4th W St., Salt Lake City, Utah, is headed by D. W. Newsome assisted by H. Hotchkiss.

Wheelco Instrument Co. — Western Div. sales office has been moved to 2320 Milwaukee Ave., Chicago.

EXPANSIONS

Acme Electric Corp.—A new wing providing approximately 7000 sq ft of

(Continued on page 114)

1952 MAINTENANCE CONFERENCE GOES TO PHILADELPHIA

Plans for the third Plant Maintenance Conference, to be held concurrently with the Plant Maintenance Show at Convention Hall, Philadelphia, Jan. 14-17, call for an intensive examination of maintenance problems.

Thirty-four separate discussions will be conducted. More than 100 experts, drawn from industrial firms all over the country, will lead the panels. Ten thousand maintenance executives are expected at the show and conference.

Six general conferences, 27 sectional meetings and the annual banquet are scheduled. General conferences will consider basic problems of all industry while the sectional meetings will be devoted to specialized subjects of interest to particular industries.

Two hundred companies will display products and services necessary for maintenance. Both conference sessions and exhibits will place the principal stress on preventive maintenance. The exhibit area will cover four times that of the first show.

● The National Production Authority, U. S. Department of Commerce, announced the membership list of the Power Steam Condenser Industry Advisory Committee as follows:

J. C. Wambach, spl. representative
Allis-Chalmers Manufacturing Co.

William M. Kennedy, president
Condenser Service & Engineering Co., Inc.

L. S. Stinson, special representative
Elliott Co.

E. R. Goodrich, vice president.
Foster Wheeler Corp.

Gordon H. Putnam, mgr.,
Condenser Div.
Ingersoll-Rand Co.

George A. Worn, general manager
Lummus Co., Manufacturing Div.

Charles H. Currier, president
Ross Heater & Manufacturing Co., Inc.

P. L. Fetzer, mgr., Condenser Sales
Westinghouse Electric Corp.

F. Leon Yetter, vice president
C. H. Wheeler Manufacturing Co.

Thomas Cruthers, vice president
Worthington Pump & Machinery Corp.

Here is *Exactly WHY* a V-Belt with CONCAVE SIDES Gives You *Longer Wear!*

To see for yourself how a V-Belt that has *concave sides* is certain to give longer wear, just make this simple test:—

Pick up any V-Belt you have at hand. Bend that belt as it bends around a pulley. As it bends, grip its sides between your fingers. Here is what will happen *everytime*.

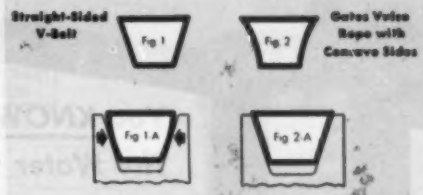
If the V-Belt you are testing has *straight sides*, you can feel those sides *bulge out* as the belt bends. This out-bulge forces the sides of the belt to press *unevenly* against the V-Pulley and you naturally get *concentrated* wear just where the bulge is greatest—as shown in figure 1-A, at right.

Now, make this same test with the belt that is built with Concave Sides—the Gates Vulco Rope!

Whereas you felt an *out-bulge* when you bent a belt with straight sides, you find that the *Concave Sides* merely fill out and become *perfectly straight*. The sides therefore *press evenly* against the V-Pulley. This distributes the wear *uniformly* across the *full width* of the belt. Naturally, this means longer belt life and *lower* belt *costs* for you!

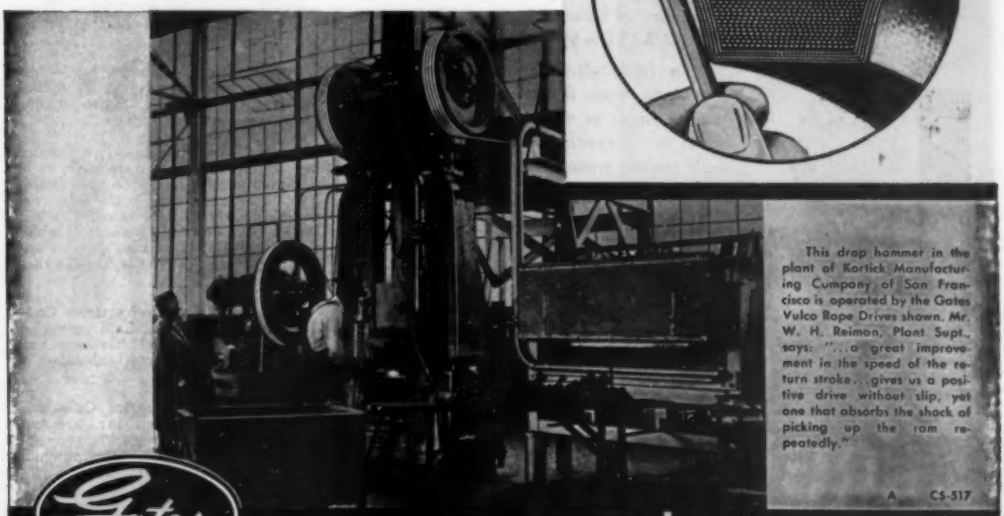
Only V-Belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure that you get the V-Belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



New Straight-Sided V-Belt Bulges In Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley — Uniform Wear — Longer Life!



This drop hammer in the plant of Kortick Manufacturing Company of San Francisco is operated by the Gates Vulco Rope Drives shown. Mr. W. H. Reiman, Plant Supt., says: "...a great improvement in the speed of the return stroke...gives us a positive drive without slip, yet one that absorbs the shock of picking up the ram repeatedly."

A CS-517

Gates® Hose V-Belts Molded Rubber Goods for Industry

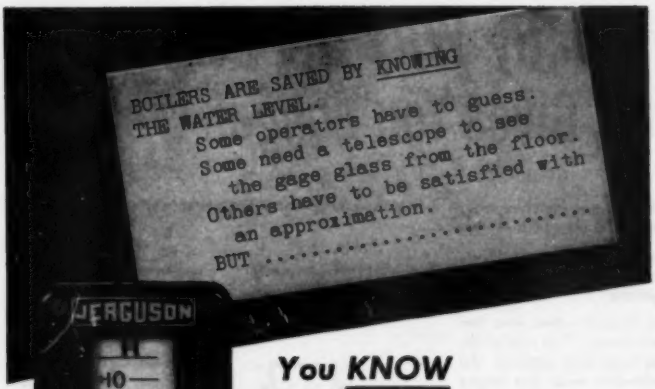
VULCO ROPE DRIVES

ENGINEERING OFFICES AND JOBBER STOCKS IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY

DENVER, U. S. A.

The World's Largest Makers of V-Belts


BOILERS ARE SAVED BY KNOWING
THE WATER LEVEL.
Some operators have to guess.
Some need a telescope to see
the gage glass from the floor.
Others have to be satisfied with
an approximation.
BUT .....

Model #2 duplicates water level as shown in gage glass at ...er

Available with visible and audible alarms at auxiliary points

Marine Operators: *Special installation procedure compensates for roll and pitch of your ship.*

You KNOW
The Water Level
When you have a

JERGUSON TRUSCALE GAGE

THE Jerguson Truscale Gage for remote reading of boiler and other liquid levels is ACCURATE to ½ of 1% of scale reading.

It is DEPENDABLE, for it works on hydrostatic heads directly from the boiler drum. Simple in design, with magnet external to manometer system, and feather-light pointer system. All internal moving parts of stainless steel; no stuffing boxes.

Models for any pressure and range; illuminated dial; scale markings and pointer glow in the dark.

Write for full information on Jerguson Truscale Gages

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

Representatives in Major Cities
Phone Listed Under JERGUSON

JERGUSON GAGE & VALVE COMPANY
100 Fellsway • Somerville 45, Mass.

European Mfg. Affiliate: Bailey Meters & Controls, Ltd.

News

of men and companies

(Continued from page 112)

floor space is being added to the transformer plant at Cuba, N. Y.

American Machine & Foundry Co.—Purchase of the Sterling Engineering Co., Inc. of Laconia, N. H., is announced. DeWalt Inc., a subsidiary, has purchased the complete "Monarch" woodworking machinery line of American Saw Mill Machinery Co. of Hackettstown, N. J.

Charles H. Besly & Co.—One-story plant being built in S. Beloit, will increase floor area approximately 20%.

Borg-Warner Corp.—Mechanics Universal Joint Div. is constructing a new $3 million, 30,000 sq ft plant at Memphis, Tenn., for the manufacture of parts for light and medium tanks.

Cleveland Pneumatic Tool Co.—Purchase of the Clayborne engine stand equipment line from Clayborne Mfg. Co., Chicago, was announced.

Conoflow Corp.—Opening of a two-story auxiliary plant to accommodate the assembly and shipping divs. is announced.

Elgin National Watch Co.—Two-story addition to the Lincoln, Neb., plant that will double manufacturing space is being constructed.

American Smelting and Refining Co.—Purchase of the Frictionless Metal Co. of St. Louis by Federated Metals Div. is announced.

Sterling Electric Motors, Inc.—Construction on plant costing $1 million has started and is expected to be completed within 60 to 90 days.

General Electric Co. — Construction has started on a new warehouse, to be occupied by the Lamp Div. in Dallas, Tex. The one-story brick bldg. will contain 45,000 sq ft of space, of which 8000 will be devoted to offices in which the Div.'s Dallas service district and southwest sales district will make their headquarters.

Harbison-Walker Refractories Co.—The Warm Springs, Calif. plant of LaClede Christy Co., has been acquired by a wholly owned subsidiary of Harbison-Walker.

Southern California Gas Co.—Mac-Isaac, Menke & Roach, Inc., are handling all phases of work connected with the expansion of gas pumping facilities in the Ventura area.

Monsanto Chemical Co.—The surface coating business of the Merrimac Div. at Everett Mass, has been sold to Raffi & Swanson, Inc.

North American Coal Corp. — Acquired The Rail & River Coal Co.

(Continued on page 116)

A WATER SOFTENER THAT HAS EVERYTHING

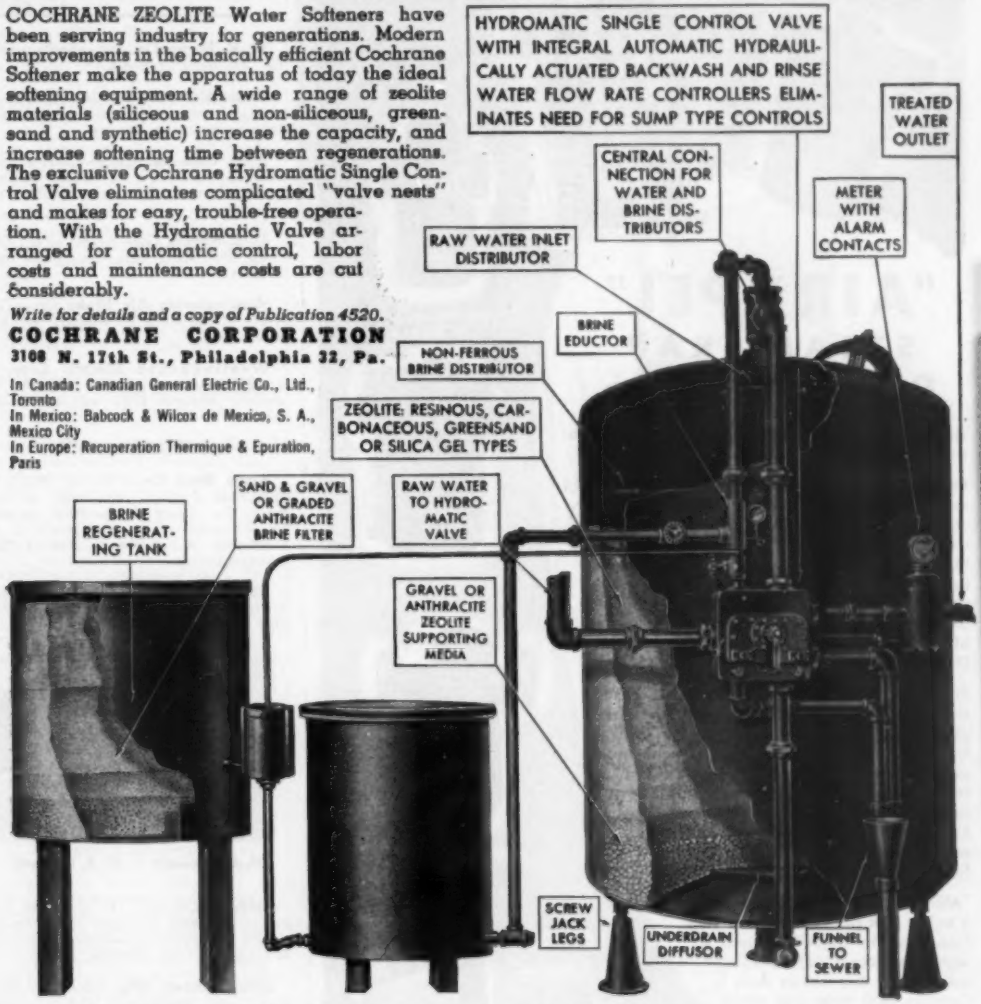
WIDE RANGE OF ZEOLITES • HYDROMATIC VALVE • AUTOMATIC CONTROLS
PLENTY OF SOFT WATER • LONGER TIME BETWEEN REGENERATIONS • SAVE ON LABOR

COCHRANE ZEOLITE Water Softeners have been serving industry for generations. Modern improvements in the basically efficient Cochrane Softener make the apparatus of today the ideal softening equipment. A wide range of zeolite materials (siliceous and non-siliceous, greensand and synthetic) increase the capacity, and increase softening time between regenerations. The exclusive Cochrane Hydromatic Single Control Valve eliminates complicated "valve nests" and makes for easy, trouble-free operation. With the Hydromatic Valve arranged for automatic control, labor costs and maintenance costs are cut considerably.

Write for details and a copy of Publication 4520.

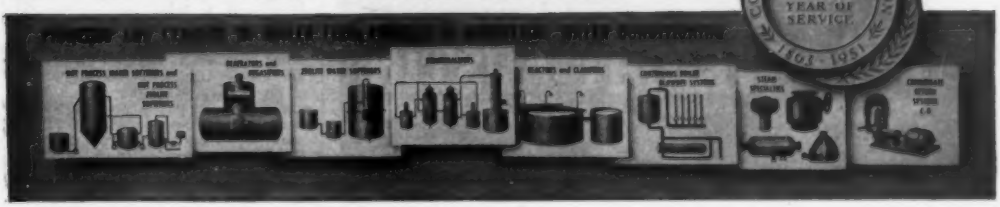
COCHRANE CORPORATION
3108 N. 17th St., Philadelphia 32, Pa.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

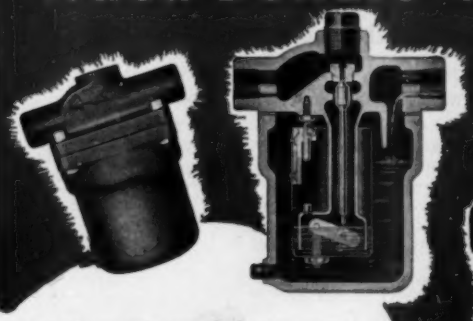

HYDROMATIC SINGLE CONTROL VALVE WITH INTEGRAL AUTOMATIC HYDRAULICALLY ACTUATED BACKWASH AND RINSE WATER FLOW RATE CONTROLLERS ELIMINATES NEED FOR SUMP TYPE CONTROLS
TREATED WATER OUTLET
CENTRAL CONNECTION FOR WATER AND BRINE DISTRIBUTORS
METER WITH ALARM CONTACTS
RAW WATER INLET DISTRIBUTOR
BRINE EDUCTOR
NON-FERROUS BRINE DISTRIBUTOR
ZEOLITE: RESINOUS, CARBONACEOUS, GREENSAND OR SILICA GEL TYPES
SAND & GRAVEL OR GRADED ANTHRACITE BRINE FILTER
RAW WATER TO HYDROMATIC VALVE
BRINE REGENERATING TANK
GRAVEL OR ANTHRACITE ZEOLITE SUPPORTING MEDIA
SCREW JACK LEGS
UNDERDRAIN DIFFUSOR
FUNNEL TO SEWER

The Cochrane Zeolite Softener with Hydromatic Valve arranged for Manual Operation

COCHRANE



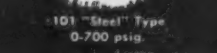
When Dollars Count



63 "Master" Type 0-300 psig.

"AIRXPEL" Type 0-300 psig.

"AIRXPEL" Steel Type 0-700 psig.



"AIRXPEL" STEAM TRAP *Proves Its Value*

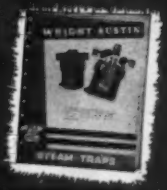
The only true test of steam trap VALUE is what the trap does AFTER it's installed.

Re-orders through the years are tangible proof that both engineers and maintenance men, as well as dollar-minded executives, like "AIRXPEL" traps—because these traps can be connected into the line and forgotten—whether the load is light or heavy, pulsating or non-pulsating, continuous or intermittent. STRAIGHT-THROUGH connections are an appreciated convenience, too. Instances of more than 20 years of uninterrupted service life are not uncommon.

Removing both AIR and CONDENSATE from steam lines in some of the largest industrial plants in the world—in vessels of the U. S. Navy and other maritime services—and in small low pressures systems, "AIRXPEL" has come to be the accepted standard of performance for open bucket steam traps. The principle of operation—its efficiency and economy, have been proven to the satisfaction of the most skeptical.

"AIRXPEL" steam traps in sizes up to 2 inches and pressures to 700 psig. Capacities to 34,500 pounds of water per hour. Complete specifications and application data in Catalog 600 help you select size and type best suited for your needs.

Send for this Catalog



WA Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN

SERVING INDUSTRY FOR MORE THAN 50 YEARS

News

of men and companies

(Continued from page 114)

H. K. Porter Co., Inc.—Buffalo Steel Co. has been acquired.

Radio Receptor Co., Inc.—Plant capacity is being increased to manufacture Germanium Diodes.

Shell Chemical Corp.—Unit for recovering sulfur from waste refinery gases will be added to the Houston operations.

U. S. Rubber Co.—Assets of the Chicago Die Mold Mfg. Co. have been acquired.

Westinghouse Air Brake Co.—Purchase of the stock of Melpar, Inc. was announced.

Westinghouse Electric Corp. — A $296,000,000 expansion program extending beyond 1953 will be undertaken.

APPOINTMENTS

Acme Steel Co. — W. G. Polley is appointed district sales mgr. at Atlanta, Ga. filling the position vacated by the death of C. A. Carrell. C. R. Lammers is southern area special representative.

Atlas Chain & Mfg. Co.—H. G. Stewart is named southern territory district mgr.

H. G. Stewart

C. E. Thomas

Chiksan Co. — C. E. Thomas has joined the sales staff and has been assigned to eastern headquarters, 155 Washington St., Newark, N. J.

Allis-Chalmers Mfg. Co.—The electrical and mechanical power depts. have been combined into a power dept. under the management of R. M. Casper. New power dept. appointments: F. W. Bush, assistant mgr. in charge of the electrical section; C. C. Jordon, assistant mgr. in charge of the mechanical section; R. N. Miers, mgr. of the steam turbine section; C. R. Braun, assistant to R. M. Casper; and E. J. Schiebenes, office mgr. W. F. Mass is named manager of the Grand Rapids district office of the General Machinery Div. succeeding G. C. Culver, a veteran of more than 40 yrs of service, who asked to be relieved of his managerial duties. T. W. Metz is appointed mgr. of the Indianapolis district of the General Machinery Div. A. Matthiesen, formerly an

assistant engineer in the turbo-power development and steam turbine depts., has been named a sales rep. in the Washington, D. C. district office. W. Winzig has been assigned to the Houston district office as a water conditioning sales rep.

American District Steam Co., Inc.—A. H. Sy, formerly sales mgr., is named v-p in charge of sales.

Ampex Electric Corp.—Appointment of H. Johnston to the post of manager of the newly created Product Engineering Div. is announced. He will headquarter at the Redwood City, Calif. factory.

Borg-Warner Corp. — Election of J. H. Ingersoll as v-p of the Ingersoll Products Div. was announced. R. F. Schutz has been named assistant treas. of the div.

Bridgeport Chain & Mfg. Co. — R. P. Sherrill has joined the company as New England district sales mgr.

Davey Compressor Co. — Appointment of R. E. Howard as comptroller and assistant treas. is announced.

Dearborn Chemical Co—R. G. Gerstmyer has been added to the sales staff. He will cover North and South Carolina with headquarters in Charlotte, N. C.

E. F. Drew & Co., Inc.—R. H. Bishop, formerly of Sylvania Electric Co., is appointed v-p in charge of sales. He succeeds G. H. Kent who has been appointed executive v-p.

General Controls Co.—New branch office in New Orleans will be in charge of R. C. Servat. E. Burnett is appointed mgr. of the newly opened branch at Omaha, Neb.

General Electric Co.—J. W. Belanger and N. M. DuChemin have been elected v-ps. C. H. Rinne is named general mgr. of the Specialty Transformer & Ballast Dept. at Fort Wayne, Ind. He succeeds W. C. Wichman, now general mgr. of the Component Products Div. C. H. Black is appointed general mgr. of the Meter & Instrument Dept. at Lynn, Mass. C. P. Fisher, Jr. is named mgr. of materials and purchasing for the Major Appliance Div. A. F. Vinson is now assistant mgr. of the Mfg. Services Div. W. A. Mattson is promoted to assistant to H. E. Strang, general mgr. of the Meter & Instrument Dept. at West Lynn, Mass. D. F. Warner is named assistant to the mgr. of engineering for the Turbine Dept. J. H. Behm is appointed staff assistant to the mgr. of engineering of the Small Apparatus Div. F. K. McCune is now assistant mgr. of the Engineering Services Div.

General Tire & Rubber Co.—Establishment of a market research dept. is announced, with H. H. McKee, Jr., former market research director at the Perfect Circle Corp., named to head the new unit.

Gorham Tool Co.—R. J. Lesnik is promoted to chief engineer.

(Continued on page 118)

COMPACT

within arms' reach

MORE STEAM

in LESS SPACE... at LESS COST!

The Clayton Forced Recirculation Steam Generator produces more steam per pound of weight and per cubic foot of space occupied than any boiler known... and at less cost. Fast steaming, automatic and safe, the Clayton Generator sets a new standard of efficiency for the production of processing steam. It is the only steam generator with a cost curve that parallels the load demand curve through all stages of operation. Each unit... 15 to 100 h. p.... is complete, ready to connect and operate upon delivery. No burners, pumps, instruments or accessories to buy.

THIS COUPON BRINGS PROOF TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

IP-11

CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

NAME_____

FIRM_____

ADDRESS_____ STATE_____

CITY_____

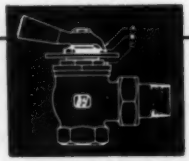
Clayton

MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

ORIFICE VALVE Type H

Simplifies Setting, Readjusting, Reading

This Barnes & Jones Valve is designed for easy adjustment to different capacities after installation and to provide a ready indication as to the *correctness* of the adjustment. When changing adjustment, no piping nor machine parts need be disconnected, and the steam system need not be shut off. Dial indicates in square feet of radiation the capacity for which the valve is adjusted.



Note Simplicity of Method of Changing Adjustment

1. Loosen lock nut (B) with pliers and reset inner dial to desired point and tighten lock nut. Loosen lock nut (C) with special B&J wrench, which we supply for this valve.

2. Turn indicator (A) in clockwise direction until valve seats.

3. Turn dial assembly so that "shut" registers with pointer of indicator. Then tighten lock nut (C).

B&J

BARNES & JONES
INCORPORATED
128 BROOKSIDE AVENUE
BOSTON 30, MASS.

Representatives in all principal cities

News

of men and companies

(Continued from page 117)

Hills-McCanna Co.—C. A. Howe, pres., has announced appointments of F. R. Grassle as assistant to the president and R. T. Kidde as general sales mgr.

Industrial Mineral Wool Institute—G. J. Christner of The Eagle Picher Sales Co. was elected president and chairman of the board; H. W. Elkins of Owens-Corning Fiberglas Corp., was elected v-p and F. Christenson of Refractory & Insulation Corp. was named treas. New directors are Elkins, E. R. Stevens of Baldwin-Hill Co., R. E. Daniels of The Federal Portland Cement Co. and N. L. Morell of N. L. Morell.

Independent Pneumatic Tool Co.—W. V. Shakespeare, former All-American football star, has been appointed sales mgr. of the Thor export sales div.

Iron Fireman Mfg. Co.—D. P. Bailey is now director of market research. The following changes in the sales organization are announced: C. F. Merrick to manager of the Central region; W. J. Fritz to manager of the Pacific Coast region; E. V. Crossin promoted to manager of the Southern region; G. L. Beauregarde appointed district sales mgr. in the Pacific Coast region; G. Armour named manager of the Northwest region; A. Traub and R. L. Plante appointed to the field organization.

Johns-Manville Corp.—E. A. Phoenix is appointed to the newly created post of manager of the market surveys dept. D. L. Hinmon is now assistant mgr. of the Transite Pipe Dept.

Lewis Welding & Engineering Corp.—J. A. Muller has joined as head of a newly formed development dept.

Lincoln Electric Co.—W. Irrgang was elected executive v-p and L. K. Stringham has been appointed chief engineer. G. G. Landis continues as engineering v-p.

Midway Tool Co., Inc.—Election of L. F. Weston, Jr. as president was announced.

Minneapol's-Honeywell Regulator Co. New industrial managers were named for the Denver, Tulsa and Kansas City branch offices of the Brown Instrument Div. W. J. Blackburn was made industrial mgr. of the Denver office, succeeding D. W. Larcen, who was recalled to active military duty. D. D. Baker was made industrial mgr. of the Kansas City office, succeeding Blackburn, J. F. Smith was appointed industrial mgr. at Tulsa.

New York Belting & Packing Co.—Appointment of W. A. Lindfors as sales mgr. was announced. He will make his headquarters in the Passaic, N. J. plant.

Nordberg Mfg. Co.—B. V. Nordberg was appointed sales engineer, four-cycle engine dept., Heavy Machinery Div.

Parker Appliance Co.—R. B. MacKenzie is named assistant sales mgr.

Perfex Corp.—Appointment of G. A. Williams, Jr. as the Ohio district representative is announced.

Pipe Protection Service, Inc.—E. R. English has joined the organization as v-p. He will be in charge of sales and will also serve as assistant general mgr.

Reliance Electric & Engineering Co.—N. E. Barnard, J. H. Himes, M. Hitchcock and W. F. Simmonds have been added to the Purchasing Dept. as buyers.

Rockwell Mfg. Co.—A. J. Kerr, v-p of meter and valve sales, has been appointed chief of the Valves and Fittings Branch, General Components Div. of the National Production Authority. C. W. Burrage, whom he succeeds, is returning to his job at The Lunkenheimer Co.

Rockwell Tools, Inc.—S. P. Owen has been appointed advertising mgr.

Link-Belt Co.—R. C. Becherer has been elected executive v-p with headquarters at the executive offices in

R. C. Becherer

R. E. Whinrey

Chicago. R. E. Whinrey, assistant general mgr. at the Ewart plant, Indianapolis, has been appointed general mgr. succeeding Becherer.

Round Chain & Mfg. Co.—Election of J. F. Ansink as v-p is announced.

Sylvania Electric Products Inc.—Appointment of R. P. Connors to the newly created post of eastern sales mgr. of the Lighting Div. was made.

Taylor Forge & Pipe Works.—The recent addition of G. Carroll to the Houston district sales office is announced.

Timken Roller Bearing Co.—G. T. Humphrey, Jr. is promoted to the post of assistant general mgr. of the service sales div.

Twin Disc Clutch Co.—Named to new positions were: G. L. Shuman, v-p, finance and secretary; R. G. DeLong, v-p, Hydraulic Div; R. T. Howell, treasurer-assistant secretary; R. T. Rehwald, assistant secretary-comptroller; W. F. Shurts, director of engineering.

Westinghouse Electric Corp.—H. A. Holden has been appointed manager of

the new Paris, Texas, plant that will start production by the end of 1951. H. F. Fox succeeds as manager of the Belleville, N. J. plant.

Woodhouse Chain Works.—O. F. Bender is named district sales mgr. in the Philadelphia area. His headquarters will be at 1326 Western Savings Fund Bldg.

Worthington Pump & Machinery Corp.—W. R. Leopold, assistant to the v-p, has been appointed to direct the operations of the Public Works Div. with D. L. Gallagher as manager of the div. Manufacturing executives named to new posts include: G. P. Passmore,

G. P. Passmore **W. R. Leopold**

assistant to the v-p in charge of manufacturing at Harrison, N. J; A. M. Tullo, works manager of the Wellsville, N. Y. plant; J. Burlick, industrial engineering assistant to the works manager at the Harrison plant; and M. A. Heyman, production control assistant to the works mgr. at the Harrison plant. Engineering executives in new posts include: W. D. Sizer, manager of regional engineering and service dept, with headquarters at Harrison; G. F. Habach, executive engineer at the Harrison plant; E. Schmachtenberg, chief engineer of the centrifugal engineering div. at the Harrison plant. H. V. Rasmussen has been appointed executive engineer at the Wellsville, N. Y. plant. J. B. Laramy is named manager of the marketing research dept. J. T. Carroll succeeds to the post of assistant mgr. of the Chicago district office. C. E. Wilson, sales v-p, has been appointed a West Coast consultant on sales problems.

The Babcock & Wilcox Tube Co.—J. H. Roach was transferred from Tulsa to the Houston office and named assistant sales manager. W. C. Mohrman, formerly located at the Houston office, was transferred to Tulsa and named a district salesman.

The Cooper-Bessemer Corp.—E. D. Van Fossen has been added to the regional field office in Seattle.

Cutler-Hammer, Inc.—A. J. Shradel is appointed manager of the Seattle district sales office succeeding T. N. Bristow who is retiring after 23 years of service.

Link-Belt Co.—B. L. Pearce is appointed chief engineer of the Ewart plant in Indianapolis, to succeed C. R. Weiss, who has retired after 42 years of service. R. T. Sweeney is named asst. chief engineer.

(Continued on page 120)

SAVE TIME WITH ARROW · HART
STRAIGHT-THRU WIRING

ARROW AH HART
TYPE "RA"
MOTOR STARTERS

Stay ahead of tough installation and maintenance schedules. Arrow-Hart's revolutionary straight-thru front wiring can save time, work and space up to 30%. This simple, versatile new system eliminates looping, U-bending and many other time and money consuming operations necessary with the "scrambled wiring" of conventional type starters. Straight-thru wiring means safer direct routing with greater separation of line and load, easy circuit identification and elimination of load terminal on line side. Installation and servicing are easier and quicker.

There's an "RA" starter for every job requirement; sizes 0-1-2-3-4 in NEMA Type I, IV, V, VII, and IX housings available. The Right Angle operating mechanism assures dependable operation and superior protection. Small size (½ that of conventional starters) means new opportunities for more compact and convenient control panel layouts.

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Here's real help in planning your starter installations. This fully illustrated booklet contains complete engineering data, operating features, dimensions and ratings for the entire "RA" line. Send for your copy TODAY.

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THREE PHASE
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Akron 19, Ohio

News

of men and companies

(Continued from page 119)

American Brake Shoe Co.—E. Johnson, jr., has been appointed executive v-p of the Southern Wheel Div. He was formerly assistant v-p. E. J. Roesch has been named superintendent of the Meadow Lands, Pa., plant of the Brake Shoe & Castings Div., and T. P. Wallace has been appointed superintendent of the div.'s Buffalo N. Y. plant.

Columbia-Southern Chemical Corp.—Several appointments in the sales organization of this subsidiary of Pittsburgh Plate Glass Co. were announced. H. W. Gleichert becomes assistant to the v-p in the new sales organization. E. W. Haley, formerly located in New York, will move to Pittsburgh as director of sales. A. W. Reynolds was made administrative assistant to the v-p in charge of sales.

Central Scientific Co.—J. T. Gossett was elected chairman of the board of directors of this company and the parent stockholding company, Cenco Corp. He succeeds the late E. P. Holder.

Fairbanks Morse & Co.—D. C. Prescott has been appointed midwestern regional sales manager for locomotive sales with headquarters in Chicago. He was formerly district manager for locomotive sales at St. Louis.

General Controls Co.—F. Wengerter is named district manager of the New York branch office.

General Electric Co.—S. Littlejohn has been elected commercial v-p. Appointment of F. C. Ruling as manager of the Atlantic district of the Apparatus Sales Div. is announced. R. B. Reid is appointed an assistant manager of the advertising and sales promotion department of the Apparatus Marketing Div.

The General Tire & Rubber Co.—M. Sanger of the Research and Development Div. has been appointed a technical consultant on rubber problems on the Rubber Div. of the Munitions Board, Washington, D. C.

Pittsburgh Corning Corp.—L. O. Griffith was elected v-p in charge of manufacturing.

A. O. Smith Corp.—J. W. Spoor has been named general sales manager of the Welding Products Div. L. F. Vonier, former sales manager, is moving into the newly created position of sales promotion manager. C. Smith is now Product Service Div. Manager.

Springfield Boiler Co.—A. D. Flower has become a member of the Philadelphia sales staff. In Los Angeles, the firm of Delmer Engineers has been appointed representatives.

Westinghouse Electric Corp.—L. R. Ludwig is appointed director of engineering and research for the Atomic Power Div. He succeeds F. R. Benedict, who is assuming new engineering responsibilities in the headquarters office. R. P. Meily is named assistant manager of the foreign engineering dept. J. W. Schaffer is promoted to the general manager's staff of the East Pittsburgh Div. His successor as industrial relations manager is C. C. Frame.

G. A. Fricke

Superior Combustion Industries, Inc.—G. A. Fricke, formerly with Griscom-Russell Co., has joined the executive staff as manager of the Heat Exchanger Div. He will direct the activities of his department from the executive offices in New York.

Minneapolis-Honeywell Regulator Co.—W. H. Sisson has been named power industry manager for the company which includes the Brown Instruments Div. He was formerly industrial manager of the Indianapolis office. He will make his headquarters at Philadelphia. G. M. Rossiter is transferred from the Milwaukee office to Indianapolis where he will become industrial manager succeeding Sisson.

Union Carbide and Carbon Corp.—A. S. Johnson has been appointed president of National Carbon Co. Div. He was formerly v-p and general manager of the div.

York Corp.—Announcement that C. F. Gibbs, director of employee publications and community relations, has been promoted to the position of assistant manager of the industrial relations div. is made.

ANNIVERSARY

Sun Oil Co.—Marked the 50th anniversary of the founding of its Marcus Hook refinery with birthday parties at Philadelphia's Convention Hall on Oct. 24 and Oct. 31.

OBITUARIES

The Timken Roller Bearing Co.—J. P. Roberts, aged 43, assistant general manager of the service sales div., was killed in an automobile accident near Spruce Pine, N. C.

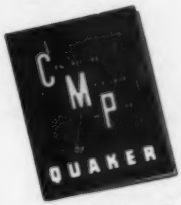
American Air Filter Co., Inc.—H. W. Pound, 55, v-p and manager of the Air Filter Sales Div. died October 10.

Boston Edison Co.—J. V. Toner, president, died suddenly at his home on October 19.

United States Gypsum Co.—W. R. Burgoyne, 38, production mgr. and asst. to the v-p died October 20.

STEP UP PRODUCTION ...KNOCK DOWN COST

QUAKER V-BELTS



FOR MORE PRODUCTION . . . GET THIS BOOK

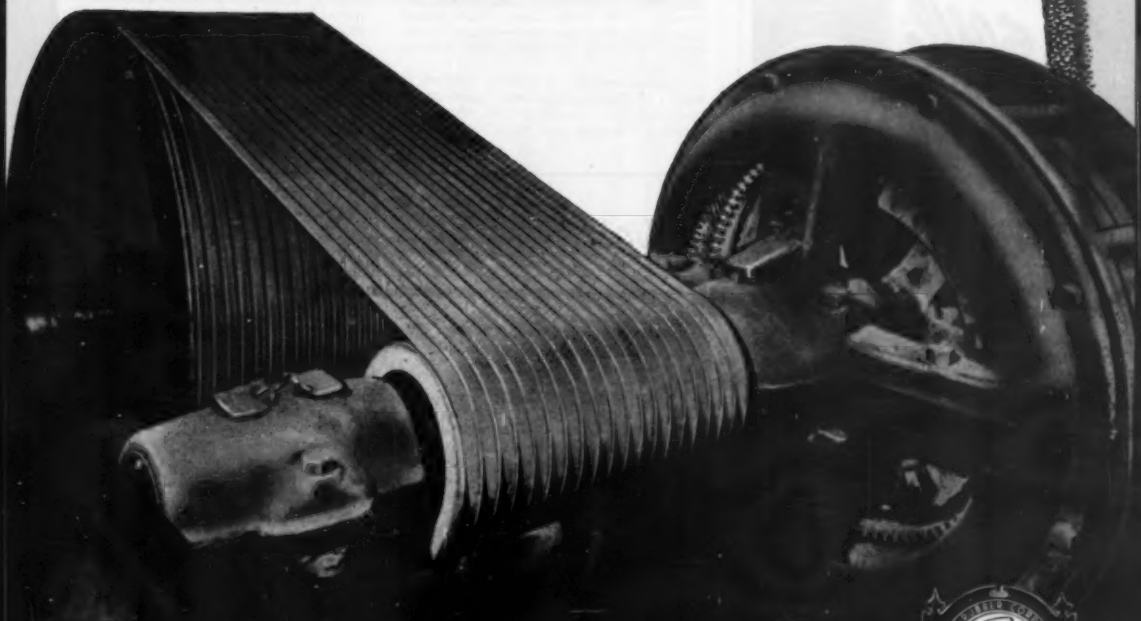
. . . and the entire QUAKER Conservation Maintenance Plan — includes maintenance memos, wall chart, factual data to help you reduce maintenance. No charge . . . no obligation.

Performance-Proved to Give Long Service

For constant high speed production and low maintenance install Quaker V-Belts. They're "service-tested" for long, trouble-free operation . . . run smoothly . . . are easy on the bearings.

The superior performance of Quaker V-Belts stems from a revolutionary construction. They are built of specially compounded materials; sinewed with husky, pre-stretched cord; specially impregnated inside and out to withstand abrasion, acidity and moisture.

Your Quaker representative will be glad to help you select the right industrial rubber product for the job . . . whether it's F.H.P. or multiple V-Belts, flat transmission belts, conveyor belts, hose, packings or moulded products. For full data write for the Quaker catalog.



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DIVISION OF H. K. PORTER COMPANY, INC.
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Up-to-the-minute CO_2 READINGS

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can save 10% OR MORE OF YOUR FUEL DOLLARS

For a quick, dependable check on CO_2 content of flue gases, use RANAREX! It's a sure check that is accurate to within 3/10 of 1% of CO_2. Ranarex uses no chemicals, is sturdily constructed and easily maintained.

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Reviews of recent books

Recent books, published for men responsible for the Engineered Plant Services, are reviewed here. Write to the publisher for those in which you are interested

A-C Motor Windings

"Alternating-Current Armature Windings" by Charles S. Siskind, ass't professor of E. E., Purdue University. Published by The McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. 231 pages illustrated with photographs, sketches and tables. Price $5.00.

By keeping instruction techniques at the level of the student and practical electrical worker, the book has been made an excellent reference work on a-c motor windings. It is a practical new text that discusses virtually every kind of modern motor. Considerable emphasis has been placed on the elementary principles underlying the various windings, their construction and various applications. Material has been carefully planned so that simple coil arrangement and winding procedures are gradually evolved into the more complex arrangements.

Single phase and polyphase windings are given special separate treatment. Numerous typical windings are worked out and studied from the standpoint of construction and design. Winding troubles, their diagnosis and location are treated in detail. Illustrative examples have been taken from actual practice so that the reader learns to associate winding principles with present day machines.

Special topics not usually treated in books of this type include: multi-speed windings for single phase windings; winding changes that must be made if motors are to be operated at different speeds, voltage, frequencies, or combinations thereof; and winding layouts for fractional slot machines.

Welding

"Welding Principles for Engineers" by J. L. Morris, ass't professor of M. E., Georgia Institute of Technology. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. 511 pages with photographs, sketches and tables. Price $7.00.

This book deals with the basic principles of all general phases of welding processes and applications but avoids going into the details of technique and instruction for the operator. Although primarily intended as a textbook for the welding engineering student, it is written in an easily-read style suited to background reading for engineers specializing in other fields.

Starting with a discussion of welding metallurgy, the author then gives a descriptive survey of the many welding processes and goes on to treat testing and inspection methods, welding of commercial metals, stresses, welding design, and economics of welding. Other phases included are brazing, surfacing, metal spraying and oxygen cutting. The chapter on filler materials, complete with tables listing the many types of electrodes manufactured today, and the discussion of their composition, properties and uses should be a valuable guide to those who are confused by the multitude of types available.

Meetings and exhibitions

Announcement of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

NOVEMBER

23rd Exposition of Chemical Industries will use all available exhibit space on the exposition floors of Grand Central Palace, New York, from Nov. 26 to Dec. 1. Write Publicity Department, 23rd Exposition of Chemical Industries, Grand Central Palace, New York.

National Metal Trades Association holds its 52nd Annual Convention at the Blackstone Hotel, Chicago, Nov. 14-16.

American Society of Mechanical Engineers plans a record program for its 1951 annual meeting in Atlantic City, N. J., Nov. 26-30. Over 220 technical papers will be presented at more than 90 sessions to be sponsored by 34 professional divisions and committees of the society in what will be the biggest meeting ever held by the ASME. Headquarters will be the Chalfonte-Haddon Hall Hotel.

JANUARY

The Plant Maintenance Show will be held at Convention Hall, Philadelphia, Jan. 14-17, 1952. Write Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

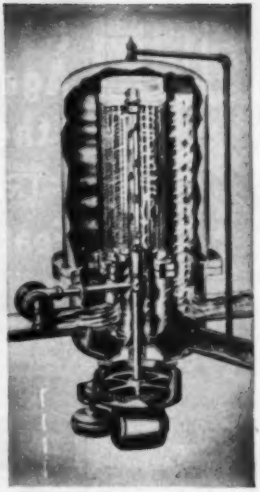
MARCH

National Association of Corrosion Engineers holds its Eighth Annual Conference and Exhibition at the Pleasure Pier in Galveston, Tex., Mar. 10-14, 1952.

Clean Raw Water
Reclaim Process Water

with this low-cost non-stop strainer

Abrasion and corrosion-resistant Cuno FLO-KLEAN handles full flow—cleans itself and discharges accumulated trash *without interrupting* flow. Can be installed in some remote place and forgotten. Some users have saved enough to pay cost of FLO-KLEAN in a few months!



CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

Aid for "Dry" Communities ... Relief from High Water Bills

Many industrial plants have solved the scarce-water problem by using raw river or lake water for plant services.

Passing such water through a Cuno FLO-KLEAN effectively strains out trash and cleans the water at rates up to 20,000 gpm, with negligible pressure drop.

Other plants use FLO-KLEAN for reclaiming used process water. Even when water isn't scarce, it still costs money, particularly if it has been heated for process work.

On this basis, Cuno FLO-KLEANS have paid for themselves in as short a time as six months.

They even reclaim their own backwash water—not wasting a drop!

Continuously Cleanable Permanent

The Cuno FLO-KLEAN positively removes all solids larger than specified. May be specified from .030 in. down to .0025 in. Operation is continuous—because the strainer is continuously self-cleaning. Therefore, full flow can be handled without needing a duplex installation.

With continuous backwash cleaning of the cartridge and automatic top and bottom blow-down, the FLO-KLEAN needs no attention.

All-metal construction is abrasive and corrosion-resistant.

Cuno Engineering Corporation
Dept. 141E, South Vine Street, Meriden, Conn.

Please send information on Cuno FLO-KLEAN for straining raw water....reclaiming process water....

Name.....Title.....

Company.....

Address.....

City.....Zone....State....

Please attach to business letterhead

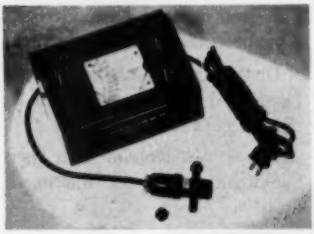
New equipment and developments

(Continued from page 21)

completely through the oil well tubing to allow gas pressure from the inside to force the Hycar rubber seal into the thread of the coupling. The seal actually comes into contact with pressures in the range of 5000 psi, but has withstood pressures up to 12,000 psi in tests. Stoneseals have been in service at temperatures up to 250 F without any appreciable failure.

26—Electronic device operates as manometer or flowmeter

Highly sensitive electronic manometer and flowmeter, having no glass or plastic tubes and containing no fluids, are announced by the Hastings Instrument Co., Inc. It operates from a noble metal thermopile using the same principles that the manufacturer applied to their vacuum and air velocity measuring instruments. To operate as a manometer two taps on the gage tube are connected with the two points at which the pressure difference is to be measured. To use the instrument as a flowmeter, the tube is placed directly in the line for low flow rates or connected to pressure taps on two sides of a calibrated orifice for high flow rates. The manometer will measure extremely low pressure differences and has a dual range of 0.001 to 0.1 and 0.1 to 2 in. water. The instrument may be used for direct indications or attached to a recorder.

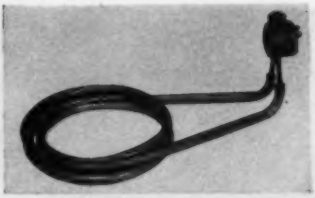


27—Immersion heaters for chemical bath

Redesign of two Calrod immersion heaters, for nickel and copper plating baths and for mild sulfuric acid and chrome plating baths has been announced by the Industrial Heating Dept. of General Electric Co. Greater flexibility and portability have been

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly



incorporated by replacing the old-style sealing cup with a junction-box of terminal housing that is vapor-tight. This terminal housing is easier to repair in the field, and relocation of the unit is more quickly accomplished. In addition, the housing reduces the possibility of faulty connections, and the terminals are readily accessible by removing the housing cover so the terminal connectors to the leads are exposed. To relocate heater, operator has only to remove the cover, disconnect the wire from the heater, place it wherever desired and then rewire. Either flexible leads or rigid conduit can be used.

28—Dynamic balance handles large equipment

The Wagner universal dynamic balancer offered by Industrial Engineering Equipment Co. is a new machine, which provides a simple method of putting armatures, rotors, pulleys, flywheels, gears, etc. in true dynamic balance. The part to be balanced is placed on the balancer with shafts resting on ball-bearing rollers and then rotated to determine the position of dynamic unbalance so that corrective weights can be added. The driving

Conditioned Water

to meet all requirements in all industries...

Automatically!

Belco's experience and manufacturing facilities are unmatched for design and production of automatic panel control of your water processing. Call us next time you consider equipment for removal of water impurities. We're sure that we can help you to your advantage. Belco Industrial Equipment Division, Inc., Paterson 3, N. J.

Belco

HEADQUARTERS FOR AUTOMATIC CONTROL OF PROCESSES FOR REMOVAL OF WATER IMPURITIES

Check the Fuse You're Using Against these TRICO Features

They're "Powder-Packed"

Don't be "short-changed" on protection

LINK PROTECTION — Fusible link protected against damage . . . Therefore no needless fuse blowings.

SAFE TIME-LAG — Just right. Prevents accidents or destruction of expensive equipment.

TAMPER-PROOF — Only ONE link of CORRECT size can be inserted. "Doubling-up" is dangerous.

TRICO OILERS

- Stop Guesswork Oiling
- End Bearing Failures
- Reduce Motor Burn-outs
- Save Oil, Time, Worry
- Easy To Install
- Sizes & Types For Most Every Application.

Write For Catalog

YOU GET 3 TIMES THE SERVICE:—

In TRICO Renewable Fuses you get that "different" link. It's CUSTOM-BUILT, "Powder-Packed", tamper-proof noninterchangeable, with Pre-determined SAFE time-lag . . . That's why TRICO gives dependable, trouble-free protection with THREE TIMES THE SERVICE.

Get The Complete Story: WRITE FOR BOOKLET 206-A

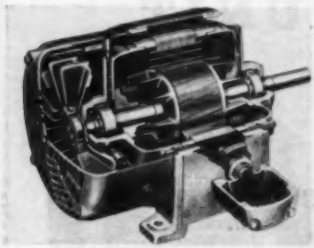
TRICO FUSE MFG. CO. Milwaukee, Wis.

mechanism consists of an arm with a set of five V-belts driven by a five hp motor. Balanced to stand in up position normally, it is lowered by the operator until the belts touch the equipment to be rotated. A starting button is pushed and when the desired

speed is reached, the arm is raised. While rotating, the shafts are marked with pencil or crayon. Because unbalance causes the shaft to rotate off center, the markings will appear on one side. The unit will balance equipment up to 48 in. diam, 4000 lb, and 80 in. between the vertical standards.

29—*Totally-enclosed motors are explosion proof*

Totally-enclosed motor for explosion-proof requirements has been developed by U. S. Electrical Motors, Inc. Made in capacities from 3 to 75 hp, it carries the Underwriters' label in Class I Group D, for highly inflammable gases and volatile liquids, and in Class II, Groups F and F, for combustible



dusts. Other types without label, for non-explosion-proof services, are also available. Features incorporated include: sealed terminal, elongated spark-arresting bearing sleeves, streamlined housing, Hi-draft ventilation, removabl cover, split hub fan, normalized castings, Lubri-flush bearings, asbestos-protected windings and solid, Centricast rotor. Being completely sealed, this motor gives protection against external hazards, preventing intrusion of abrasives.

30—*Triplex pump operates at 500 psi head*

Compact high pressure triplex pump has recently been introduced by Kobe Inc. Div. of Dresser Equipment Co. It is a heavy-duty

(Continued on page 126)

For easier installation — Lower maintenance

TYPE B DESIGN FEATURES

- Factory fabricated boilers require minimum field work.
- In many cases, sizes up to 25,000 lbs. per hour can be shipped completely assembled.
- Water tubes along furnace side walls reduce maintenance costs.
- Furnace design provides high efficiency with any method of firing.
- Extremely low head room. Maximum capacity for floor area.
- Can be operated at high overloads without disturbing water level.

Write for free catalog on the Type B or on any of the units listed below.

Boilers By Bigelow

Water Tube Boilers — Bent Tube Types • Horizontal Return Tubular Boilers • Scotch Type Boilers • Two-Pass Boilers • Electric Steam Generators

This Type B — Boiler By Bigelow being installed was shipped completely assembled. It has a capacity of 20,000 lbs. steam per hr. continuous, 25,000 lbs. steam per hr. peak loads. The boiler is 10'7" wide, 21'9" long, 15'10" high and has 3,287 square feet of heating surface.

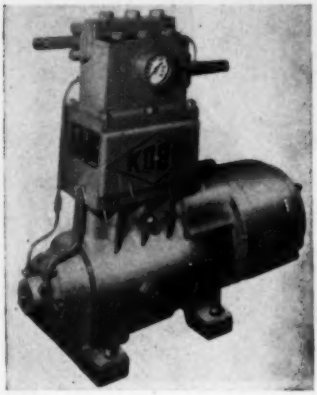
THE BIGELOW COMPANY • NEW HAVEN 3, CONN.

BIGELOW REPRESENTATIVES: Boston • New York • Philadelphia • Syracuse • Detroit • Chicago • Atlanta • Milwaukee • New Orleans • Oklahoma City • Petersburg, Va. • Washington, D.C. • Albuquerque • San Francisco • Seattle • Sumter, S.C.

New equipment and developments

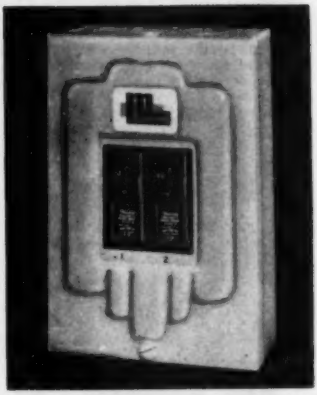
(Continued from page 125)

packaged hydraulic power generator for li types of hydraulic power systems. The unit is available in 15, 30 and 50 hp sizes with pressure ratings up to 5000 psi and displacement to 60 gpm. Special 10,000 and 20,000 psi heads are available. Integral gears are included and are available in a wide variety of ratios. Unit can be obtained with an integral, drip-proof Sterling electric motor drive, which greatly simplifies installation problems common to this type of pump. Plungers and liners are interchangeable, and a variety of pressure-volume ratings is provided for each unit. Spring loaded balls and hardened-and-ground seats serve as inlet and outlet valves. Pressure lubrication is a built-in feature and includes a gage, relief valve and scavenger pump.



31—Two circuit load center has 55 amp capacity

Two circuit load center that will continuously carry 100 per cent full rated load has been announced by Murray Mfg. Co. It has a rated 55 amp main with a capacity of two 50 amp, single pole, 120 a-c fully magnetic circuit breakers. Fully magnetic action differs from the action of all thermal devices in that rated operation does not change with changes in temperature. This 55 amp load center can be used as a main disconnect in place of a comparable 60 amp fused switch.



It has specific application as a service entrance and main disconnect switch and for use on lighting and appliance circuits.

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly

32—Synchronous motor weighs only 2.6 lb

A small synchronous motor with unusual operating characteristics has been announced by Allis-Chalmers Mfg. Co. that operates on the reluctance principle and has no brushes, slip rings, rotating coils or permanent magnet. It can be built to operate continuously at any voltage below 250, either single phase or polyphase. A typical motor is 4

(Continued on page 128)

Nicholson Expansion Steam Traps

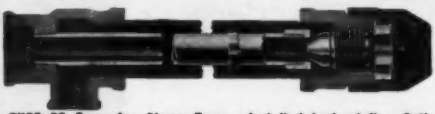
SAVE $155 PER UNIT

for Large Processor

Because of their positive effectiveness in temperature control work, Nicholson expansion steam traps, at about $35 each, are being installed by a leading processor in place of temperature controls. These were costing them $110.00 to $200.00, with cost of a trap added. Per installation, the saving is about $155.00.

This firm is finding an increasing number of applications on tanks, stills, heating radiators, etc., where Nicholson expansion steam traps are serving as both trap and temperature controller.

Because there is only one moving part, remarkably low maintenance costs are being shown. Easily installed, usually without supports. Lengths, 9" to 40". Pressures, 0 to 250 lbs. No air binding.



TYPE RF Expansion Steam Trap — Installed horizontally. Both types are for steam or hot water; pressure to 250 lbs.

TYPE SF—Installed horizontally or vertically without supports

For All Equipment Using Steam or Hot Water

Radiators	Kettles	Switch Heaters
Separators	Railway Coaches	Laundries
Paper Machinery	Dry Kilns	Plastic Molding
Pipe Coils	Vulcanizers	Presses

Catalog 751 or see Sweet's

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 Oregon St., Wilkes-Barre, Pa.

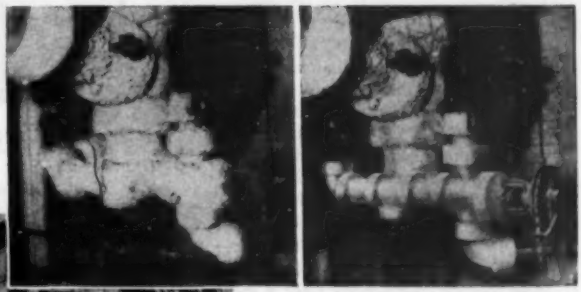
Now MORE REASONS THAN EVER FOR USING

STIC-TITE
PLASTIC INSULATION

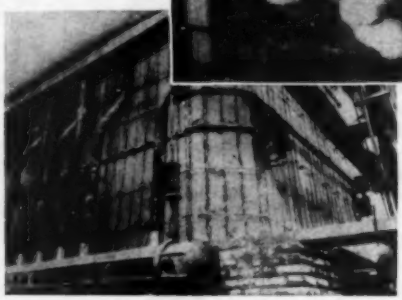
The All-Purpose Insulation that Solves Your Shortage Problem. Delivery NOW

For Boilers, Heaters, Tanks, Pumps, Breechings, Ducts, Piping, Flanges, Valves, Fittings

1—Easy to Apply to Any Surface
2—Strong · Light · Adhesive
3—Efficient to 1800° F.
4—100 Lbs. Covers 45 Sq. Ft.—1" Thick
5—Low Cost for Material and Labor
6—Fully Reclaimable—Never Wasted
7—Finishes Smooth—Easy to Paint



Water walls of large boiler insulated with 6" of Stic-Tite over pencil rod reinforcement. Rough coat later covered with a smooth finish coat of Stic-Tite cement.



Elbows, flanges and fittings easily rough-coated with Stic-Tite, without reinforcement. At right—same job smooth-finished, troweled over roughing coat with same Stic-Tite mixture. Both coats easily reclaimed, without loss, in event of repairs.

Get the Facts.
Get Free Sample for TEST.
Send This Coupon.

REFRACTORY & INSULATION CORP., 118 Wall St., New York 5, N. Y.

Send me STIC-TITE bulletin; also ☐ Sample ☐ Prices

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

These EVERLASTING advantages give better service from

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Angle Blowing Valve.

BOILER BLOW-OFF VALVES

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The sealing valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non-wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The blowing valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

Write for descriptive bulletin

EVERLASTING VALVE CO.
49 Fisk Street, Jersey City 5, N. J.

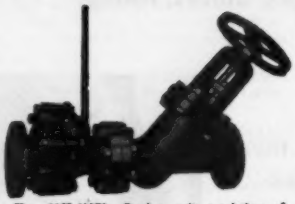


Fig. 4001/6371. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Y Blowing Valve.

Fig. 6571/6561. Duplex unit consisting of Y Sealing Valve and Angle Blowing Valve.

Fig. 6561/6571. Duplex unit consisting of Angle Sealing Valve and Y Blowing Valve.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF. EV-240

FOR EVERLASTING PROTECTION

New equipment and developments

(Continued from page 126)

in. in dia. by 2⅜ in. long, weighs 2.6 lb and develops 8 oz-in. starting torque and 0.8 in. synchronous torque. Simplicity of construction provides high stock resistance and practically no maintenance. No starting equipment is required, the motor being able to start and pull into step at any frequency from 10 to 400 c.

TO REQUEST ADDITIONAL FREE DATA

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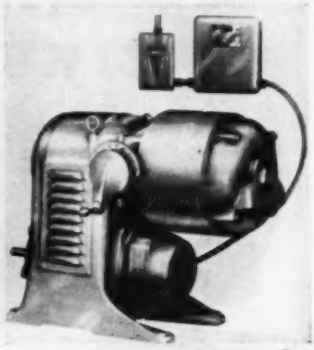
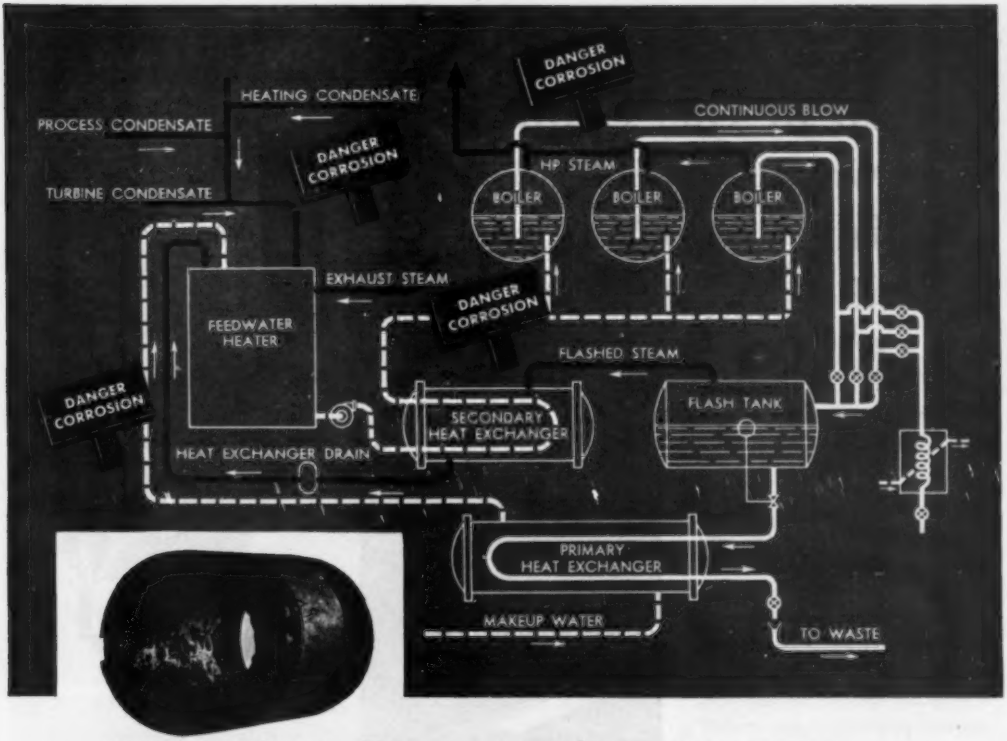
33—*Breaking torque easily adjusted*

Fast, controlled braking of U. S. Varidrive motors is now possible through a new development of U. S. Electrical Motors, Inc. The brake used, a Warner type ICB, is mounted directly on the variable speed shaft, eliminating transmission of the braking action through the belt. Ideal for inching or jogging, the ICB offers instant, shockless operation without noise and pro-



duces a constantly increasing torque during stopping. Containing few parts, the brake has a mechanical movement of only 1/16 in., and its frictional force is controlled directly by the magnetic action of the brake. Easily and accurately adjusted through a knob-controlled rheostat, the braking torque, once set, is permanent. Adaptable to both U. S. Varidrives and Varidrive-Syncrogears, this brake is d-c actuated with low power requirements—maximum 25-35 w. Power conversion units are used where a-c voltage is supplied.

(Continued on page 130)



AVOID These Danger Signs with BIRD-ARCHER Amine Treatment

CORRODED condensate return lines lead to expensive pipe replacement and maintenance. As an added annoyance, the solid products of corrosion often plug return lines and fill traps. You can steer clear of these troubles by using the *effective, economical* Bird-Archer Amine Treatment.

HERE'S THE WAY THIS B-A TREATMENT WORKS

Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself.

HERE'S HOW THIS B-A TREATMENT SAVES MONEY

Raising the pH value of the condensate severely decreases maintenance costs by eliminating corrosion. These savings may more than offset the amount of treatment required to provide protection for your equipment.

NEW BULLETIN gives full details on the Bird-Archer Amine Treatment. . . . contains case histories that prove its successful application in many plants. *Write for your copy today.*

BA-154

WHAT AMINES ARE

Amines are members of a class of chemical compounds in which one or more hydrogen atoms of the ammonia molecule are substituted by an organic group. Some of the simpler types are soluble and volatilize from boiler waters. The alkalinity of the amines is an inherent property and does not result from decomposition. *No free ammonia is released.* In the concentrations necessary for protection of condensate systems, amines are harmless to non-ferrous metals, non-toxic and are completely stable at temperatures approximating 675F.

BIRD-ARCHER
WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO
IN CANADA: The Bird-Archer Co., Limited, 503 McGill Building, Montreal
IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 391, Mexico, D. F.

You Get Trustworthy Liquid or Gas Cooling With Great Cooling Water Savings from the NIAGARA AERO HEAT EXCHANGER

● You can cool air, gas, water, oils, chemicals, electric and power and process equipment, engines, mechanical processes with lower cost and really accurate control of temperature with the Niagara Aero Heat Exchanger.

You are assured of uniform, constant production and quality from any process . . . steady, reliable operation . . . lower cost for more dependable cooling. You can have closed system cooling with freedom from scale, dirt, corrosion and maintenance troubles. You can accurately cool more than one type of liquid with one machine.

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling. You can remove heat at the rate of input to keep accurate control of gas or liquid temperature. You can put heat back into the system to save the losses of a "warm-up" period or to equalize the effect of load variations.

Great savings in cooling water and savings in piping, pumping and power return the cost to you quickly. The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 96.

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. New York 17, N. Y.

Experienced District Engineers in all Principal Cities

New equipment and developments

(Continued from page 128)

34—Condensate return units effect savings in fuel

A unit that effects a considerable saving in fuel by returning the condensate from steam coils, radiators or steam operated equipment to the boiler is announced by The Deming Co. "Motor-Mount" centrifugal pumps, used on these units, have enclosed type bronze impeller and stainless steel shaft. The deep stuffing box has conventional packing rings for grease lubrication. Pump is mounted on the legs of the

tank so no base is required. Motor has standard NEMA type "C" mounting flange and is furnished for single, two or three phase or direct current, as specified. Complete line includes single and duplex units —the duplex units designed for conditions involving occasional demands in excess of the capacity of a single unit, or where a standby pump is desired to assure continuous operation under all conditions. Selection of 44 unit numbers in both single and duplex units are designed to handle from 2000 to 40,000 sq ft of radiation.

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly

35—Time delay switch protects arc welders

A starter, basically a fused high-capacity interrupter switch, is now being used on all production models of General Electric's Type WD-42, -43 and -44 motor generator d-c arc welders. According to G-E engineers, the starter provides positive motor starting because the contacts are locked in by mechanical action. A direct-acting lever phys-

(Continued on page 144)

CUTS COSTS

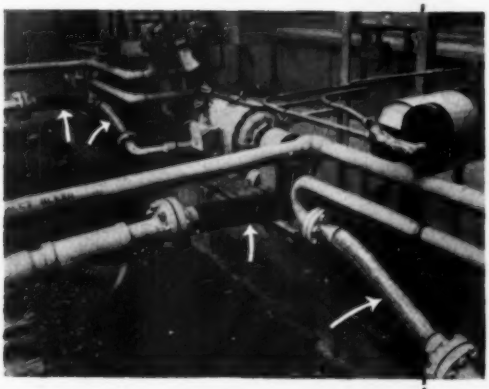
There are two ways to make more money: cut your costs—increase your sales. American Flexible Metal Hose and Seamless Flexible Metal Tubing have cut many manufacturers' product costs by simplifying assembly; have made many products more useful and more salable.

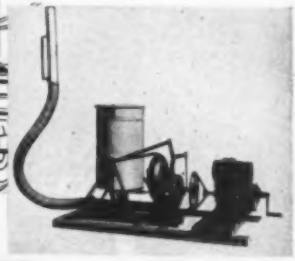
SELLS PRODUCTS

Investigate these versatile, strong, tight, flexible connectors for *your* product—for connecting piping or ports that move, vibrate or are out of alignment. There's a type for conveying liquids, gases, semisolids, chemicals and oils under severe conditions of temperature, pressure, corrosion and stress. Write now for Bulletins SS-50 and CC-300. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

SPOUTS DEADLY DUST

American Lightweight Flexible Metal Hose directs the dust from this Simplex Orchard Duster of the Simplex Mfg. Co., McQueeney, Texas. Uniform flexibility for ease of handling, no complicated parts to break or get out of order and ease of detaching won the job for American Flexible Metal Hose.



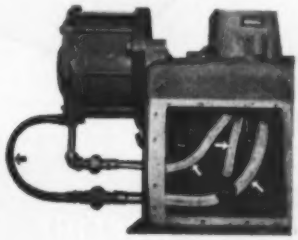


SOAKS UP SHOCKS

Four American Stainless Steel Flexible Tubing assemblies absorb shock from vaporization and hammer in suction and discharge of high-pressure pumps at Willow Island, W. Va., plant of American Cyanamid Co.

TIGHT SQUEEZE

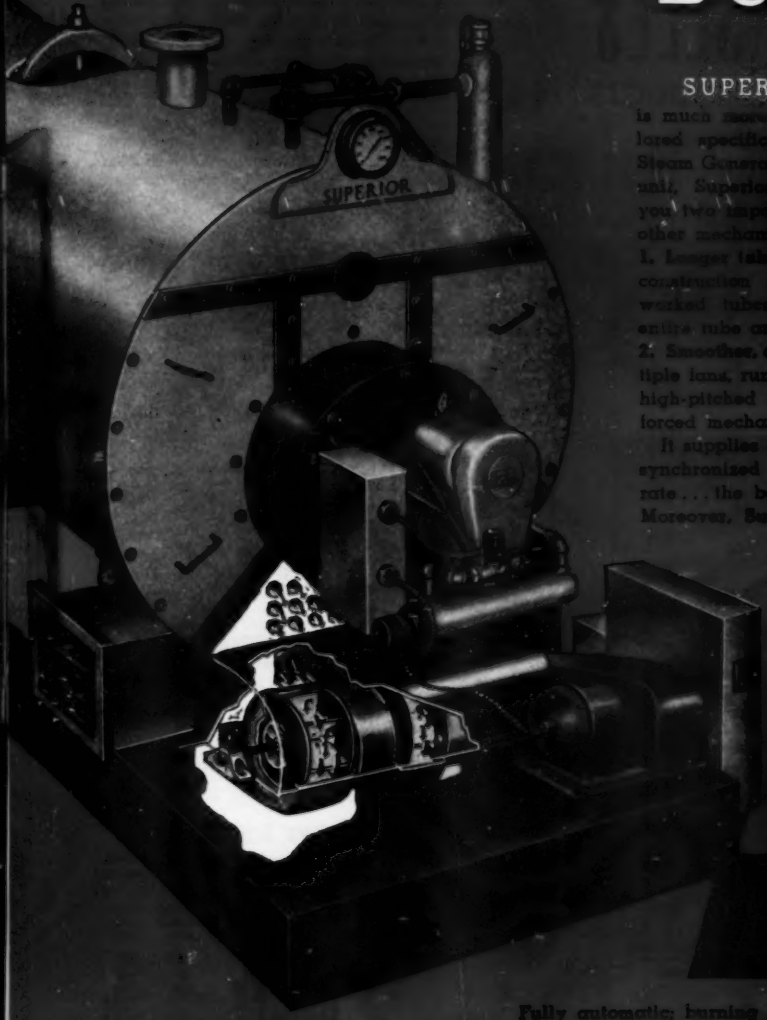
American Seamless Flexible Bronze Tubing saves a lot of time and money in making the compressed air connections on this tube beading and flaring machine. Note flexible tubing's workability in confined spaces.



WHEREVER CONNECTORS MUST MOVE... ANACONDA *American*

FLEXIBLE METAL HOSE AND TUBING

BETTER *because it's* BUILT-IN



SUPERIOR'S INDUCED DRAFT is much more than accessory equipment. Tailored specifically to its function in Superior Steam Generators, and built-in as an integrated unit, Superior's Induced Draft System offers you two important advantages not common to other mechanical-draft boilers.

1. Longer Tube Life . . . because full-width fan construction minimizes the danger of over-worked tubes by its even draw across the entire tube area.

2. Smoother, quieter operation . . . because multiple fans, running at low speeds, eliminate the high-pitched whine commonly associated with forced mechanical draft.

It supplies air in precisely measured volume, synchronized with the oil flow at every firing rate . . . the basis of high operating efficiency. Moreover, Superior's Induced Draft eliminates the possibility of forcing combustion gases into the boiler room.

These, in themselves, are very substantial reasons for specifying Superior Steam Generators; but for the whole story, write for Catalog 302.

STEAM GENERATORS

Fully automatic; burning gas or oil, or both.
80% thermal efficiency guaranteed.
18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i.

Superior Combustion Industries, Inc.

Factory: Sunmans Pa
Executive Offices: Times Tower Times Square New York 18 N Y

3 special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in

ENGINEERED PLANT SERVICES

1. NEW EQUIPMENT

Begins on page 8

Contains highlights of new products by leading manufacturers, briefed and illustrated for your easy reference. Complete data on each of these products are available ***free.***

2. NEW BULLETINS

Begins on page 24

Includes descriptions of only those bulletins and catalogs that are really ***new*** and of ***direct value*** to you — saves your reading time, yet gives you full service. All bulletins sent to you ***free*** on request.

3. READERS GUIDE TO ADVERTISED PRODUCTS

Begins on page 135

Designed to catalog advertised products for your convenience in finding the ads which are of special interest to you at this time. Also lists those important bulletins, catalogs and working data offered ***free*** in the advertisements.

REQUEST CARD FOR LITERATURE OR MORE INFORMATION—Nov., 1951

To: INDUSTRY AND POWER, St. Joseph, Mich. Please have forwarded to me, at no obligation, the free literature I've indicated by the following key or paragraph numbers:

New Equipment begins Page 8	*New Bulletins begins Page 24*	*Advertised Products begins Page 135*
No.'s	No.'s	No.'s

Your Name _____ **Title** _____

Your Company _____

Co. Address (St. & No.) _____

City _____ **State** _____

Inquiries for items listed in this issue not serviced beyond Feb. 1, 1952

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

2¢—POSTAGE WILL BE PAID BY

INDUSTRY AND POWER

420 MAIN STREET

ST. JOSEPH, MICH.

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

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Co. Address (St. & No.) _____

City _____ **State** _____

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Readers' guide to advertised products

This department is both a product index for advertising and a keyed listing for advertised literature. List paragraph key numbers on reader service card to get data you want.

See Reader Service Card Page 133

AIR & DUST FILTERS & COLLECTORS

Electrical Precipitation **500**

New method of cleaning electrodes involves continuous or sequential rapping at a controlled vibrational intensity. Write for Bulletin FA. Research Corp. See page 7.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Rust Preventive **501**

Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in full range of colors. Write for data. Rust-Oleum Corp. See page 41.

BOILERS & BOILER ACCESSORIES

Vane Control **502**

Sturtevant Vane Control is the economical way to obtain variable fan output at high efficiency. Write for data. Westinghouse Electric Corp., Sturtevant Div. See page 38, 39.

Continuous Blowdown **503**

Packet-type automatic continuous blow-down provides completely automatic control of boiler water concentration. Write for free Blowdown Chart. Henszey Co. See page 143.

Generators **504**

Mail coupon on page 117 for catalog and desk demonstration of Clayton Forced Recirculation Steam Generators. Clayton Mfg. Co. See page 117.

Boilers **505**

Kewanee heavy-duty firebox boilers are especially adapted for high pressure. Write for 6" scale with pipe diameter markings. Kewanee Boiler Corp. See page 152.

BUILDING HEATING, VENTILATING, AIR CONDITIONING & REFRIGERATION

Air Conditioning **506**

Whatever your heating, cooling, ventilating or air conditioning problem is, look for the answer in the complete Trane line. Write today. The Trane Co. See page 137.

BUILDING MATERIALS & MAINTENANCE

Iron Cement **507**

Write for free 40-page repair handbook describing Smooth-On repairs that can save you time and money. 170 illustrations. Smooth-On Mfg. Co. See page 151.

Steel Grating **508**

See page 138 which lists 5 built-in advantages found in Blaw-Knox electroforged steel grating. Write for complete data. Blaw-Knox Div., of Blaw-Knox Co. See page 138.

Floor Patch **509**

Send coupon in ad for complete details of trial order plan and Handbook of Building Maintenance. Flexrock Co. See page 146.

COAL, ASH & BULK HANDLING

Conveyor Belting **510**

Hot materials conveyor belting is one of the many Hewitt-Robins "firsts" in materials handling belting, machinery and techniques. Write for solution of your conveyor problems. Hewitt-Robins. See page 153.

Coal Handling **511**

Stephens-Adamson engineers are at your service to solve your bulk materials handling problems quickly and economically. Write today. Stephens-Adamson Mfg. Co. See page 46.

Locomotives **512**

Davenport and Porter locomotives are designed and built to deliver economical, trouble-free rail haulage through extra years of service. Write for data. Davenport Locomotive Div., Davenport Besler Corp. See page 151.

Pulverizer **513**

The Micro-Pulverizer produces outstanding results in handling of heat-sensitive materials. A free test may solve your problem. Pulverizing Machinery Co. See page 144.

Conveyor **514**

The Hi-Hopper Conveyor is a "sure-fire" method to keep your stoker operating longer, saving time and money. Write for literature on this and other conveyors. New London Engineering Co. See page 152.

Electric Vibrators **515**

Write for illustrated folder with full

(Continued on page 136)

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Readers' guide to advertised products

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information on electric vibrators for bins, hoppers and chutes assuring free flowing coal. Syntron Co. See page 157.

CONTROLS, REGULATORS & INSTRUMENTS

Gages **516**
See page 166 that lists 5 ways to use Hays' low pressure gages. Write for Bull. 49-667 describing the complete line of Hays' low pressure instruments. The Hays Corp. See page 166.

Indicator & Recorder **517**
For a quick, dependable check on CO_2 content of flue gases, use Ranarex. Write for free booklet. The Permutit Co. See page 122.

Temperature Regulators **518**
Write for Stacon Bulletin 50-100 for full details on extra sensitive, accurate, economical temperature regulators. Farris Stacon Corp. See page 140.

Gages **519**
Write for full information on Jerguson Truscale Gages for remote reading of boiler and other liquid levels accurate to ½ of 1% of scale reading. Jerguson Gage and Valve Co. See page 114.

Instruments **520**
Whether for laboratory, shop or field requirements, first check instrument needs with Weston. Consult nearest representative or write direct. Weston Electrical Instrument Corp. See page 62.

Regulators **521**
Spence regulators give you accurate regulation and long, trouble-free life. Write for Bulletin 350 with complete details. Spence Engineering Co., Inc. See page 60.

Tank Gage **522**
Write for complete details on liquid level gages for measuring liquids of all kinds. 100% automatic. The Liquidometer Corp. See page 146.

Temperature Control **523**
Simplify your temperature control problems with Powers No. 11 temperature indicating regulators. Write for Bulletin 329. The Powers Regulator Co. See page 154.

CRANES, HOISTS & CAR PULLERS

Handling Equipment **524**
More power to materials handling with Silent Hoist Krane Kar and Car Pullers. Write for Bulletins 79 and 64A. Silent Hoist & Crane Co. See page 165.

ELECTRICAL DISTRIBUTION

Fuses **525**
Write for Economy Catalog and Price List with complete information on "Economy De-Lay" Renewable Fuses for protection where time delay is most needed. Economy Fuse & Mfg Co. See page 161.

Transformers **526**
Write for Folder on Powerstat Variable Transformers. Complete with product and application data, rating charts, circuit diagrams and dimensions on variable voltage control equipment. The Superior Electric Co. See page 48.

Fuses **527**
Trico Renewable Fuses give dependable, trouble-free protection with three times the service. Write for Booklet 206-A. Trico Fuse Mfg. Co. See page 124.

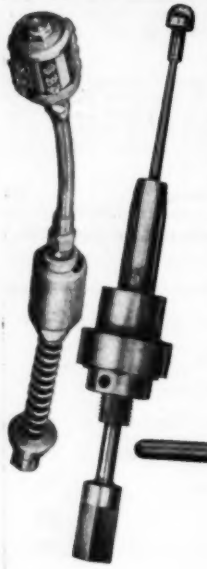
Motor Starters **528**
Write for free booklet with complete engineering data, operating features, dimensions and ratings for entire "RA" line of motor starters. The Arrow-Hart & Hegeman Electric Co. See page 119.

Fuses **529**
Send coupon for complete facts on Fusetron dual-element fuses that offer protection in 10 ways, as described in advertisment. Bussmann Mfg. Co. See pages 26, 27.

Transformers **530**
Mail coupon on page 120 for addition-

(Continued on page 138)

WILSON 3-WAY SERVICE TEAM



WILSON TUBE CLEANERS make short work of the toughest deposits. They provide faster, more thorough, more economical tube cleaning which decreases maintenance costs and increases production time. Driven by air, water, steam or electricity, Wilson Tube Cleaners are available for straight or curved, ferrous or non-ferrous tubes from 3/8" to the largest ever cleaned.

WILSON TUBE EXPANDERS are precision-made. Their smooth efficient rolling action insures firm seating of the tube . . . provides perfectly rolled joints . . . reduces time-wasting re-rolling and re-inspection. There is a Wilson Tube Expander for every conceivable need, from 3/16" I.D. to 12" I.D. for use in power plants, refineries, boilers, heat exchangers, etc.

WILSON-DUNTON SAFETY BOLT eliminates the "human element" . . . makes it impossible to pull a hot industrial or marine oil burner with the pressure on. It is easy to install, reduces fire hazard, cuts liabilities. First cost is only cost. This long-needed safety device is available for most popular makes of oil burners.

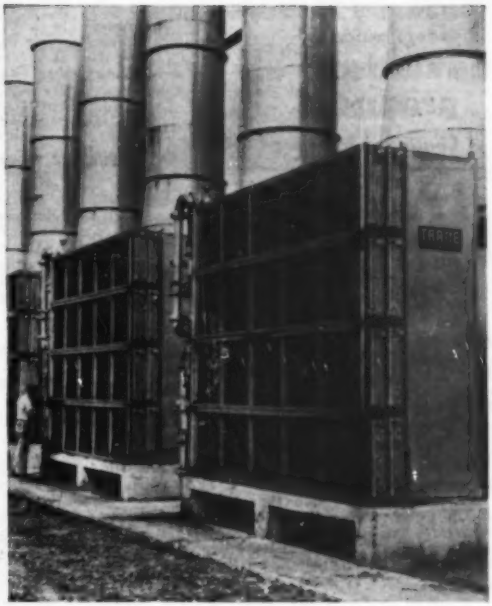
WRITE FOR BULLETINS

THOMAS C. WILSON, INC., 21-11 44TH AVE., LONG ISLAND CITY 1, N.Y. • CABLE "TUBECLEAN" NEW YORK

WILSON

TW-789

WILSON TUBE CLEANERS • WILSON TUBE EXPANDERS



Laboratory . . . Reduction Plant . . . Assembly . . . Dock . . . Service Station

Trane Air Conditioning Serves Everywhere in Industry

Industries of every kind and size are finding the answers to their heating and air conditioning problems in the broad Trane line.

Constant Temperature Fog Room—A cement manufacturer wanted to test concrete specimens under extreme humidity conditions, at constant temperatures. Trane Climate Changers kept the test room at 73° constantly the year around.

To Cool Gas Engines—The location of a new aluminum reduction plant in the south had plenty of natural gas and good transportation. But there was no water to cool the 120 1800-hp engines used for power. This situation was remedied when 120 Trane Fluid Coolers were installed to keep jacket water at just the proper temperature.

Window Blanketing — The windows in the new plant of a scale manufacturer admitted plenty of light to a delicate assembly line. But the great glass area created greater possibilities for drafts. That is until Trane Wall-Fin Heaters were installed to blanket the windows with heat without obscuring the light.

Washing the Walls with Heat — Long loading docks, like the one in a Michigan chemical plant, call for a lot of heat to combat the cold air from constantly opened doors. A battery of Trane Horizontal Unit Heaters wash the exposed walls and blanket the doorways with all the heat that's needed.

Tempering Freezing Air — The diesels of a famous railroad discharge a lot of gas-laden air as they enter a terminal service station. As the bad air is exhausted, clean outside air is brought in and heated with Trane Nonfreeze Heating Coils.

Whether it's laboratories, reduction plants, assembly, docks or service stations, Trane air conditioning serves industry everywhere.

Whatever your factory heating, ventilating, cooling or air conditioning problem, look for the answer in the complete Trane line.

In Assembly Departments—Trane Wall-Fin Heaters are tucked up under the girders.

In Loading Areas—Trane Horizontal Propeller Unit Heaters kill drafts before they start.

In Service Stations—Cold outside air is heated with Trane Coils before it is used for ventilation.

TRANE

MANUFACTURING ENGINEERS
OF HEATING, VENTILATING AND
AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . Toronto
OFFICES IN 80 U. S. and 14 CANADIAN CITIES

Readers' guide to advertised products

(Continued from page 136)

al data on Stockwell distribution and power transformers for fast reliable service. Stockwell Transformer Corp. See page 120.

ENGINES

Engines **531**
General information on Dual Fuel Engines. Worthington Pump & Machinery Corp., Engine Div. See page 59.

FANS AND BLOWERS

Blowers **532**
Check and mail coupon on page 25 for full information on how Coppus blowers or exhausters supply fresh air to men working, and step up production. Coppus Engineering Corp. See page 25.

Blowers **533**
Write for complete details and latest bulletins on Wing Axial Flow Blowers . . . for compactness, ease of regulation and low maintenance. L. J. Wing Mfg. Co. See page 158.

Blowers **534**
Write for free Bull. A-650 with complete data on Hoffman multistage centrifugal blowers. Bulletins also available on heavy-duty industrial vacuum cleaning equipment. U. S. Hoffman Machy. Corp. See page 160.

FUELS & FIRING EQUIPMENT

Coal **535**
Bell & Zoller have the assortment of coals, plus the facilities and production of capacity, to meet your specific requirements in quantity, quality, and cost. Write today. Bell & Zoller Co. See page 47.

Fuel Oil Additive **536**
Houghto-Solv dissolves sludge fast, keeps new sludge from forming, and gives more Btu's for the money. Order a trial drum now. E. F. Houghton & Co. See page 162.

Stokers **537**
Send coupon on page 108 for further data and free heating analysis on commercial models of Combustioneer automatic coal stokers. Combustioneer, The Steel Products Engr. Co. See page 108.

Burners **538**
Enco oil and gas burner units are made in many sizes to suit all capacity requirements. Bulletin on request. The Engineer Co. See page 49.

Coal **539**
If you have a coal problem, consult the Beacon Combustion Service Man for the type to fit your exact needs from the Beacon line of quality fuels. Eastern Gas & Fuel Assoc. See page 3.

HEAT EXCHANGER EQUIPMENT

Cooling Towers **540**
Pritchard towers guaranteed to meet your peak as well as normal load requirements—effect maximum saving of water. Write for Bulletins. J. F. Pritchard & Co. See page 148.

Exchangers **541**
Write for Bulletin HE-7 that describes typical installations of Vogt Film Type exchangers. Henry Vogt Machine Co. See page 52.

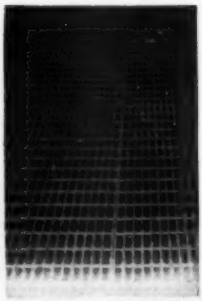
Heat Exchanger **542**
The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 96. Niagara Blower Co. See page 130.

Deaerators **543**
General information on steam-jet deaerators. Worthington Pump & Machinery Corp., Steam Power Div. See page 61.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Colloidal Graphite **544**
Write for details on "dag" colloidal graphite for general lubrication, extreme temperature lubrication, parting, impregnation, and opaquing. Acheson Colloids Corp. See page 105.

FIRST EXAMINE . . . THEN SELECT THE GRATING WITH ALL 5 SUPERIOR FEATURES!

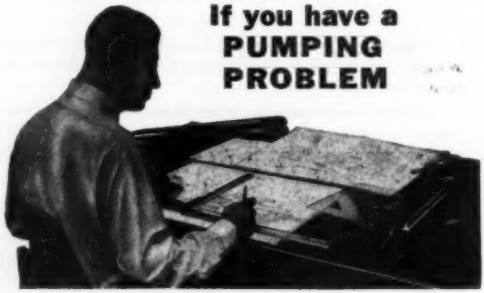


1. STRONG electroforged construction for easy installation.
2. MAXIMUM OPEN AREA for light and air.
3. EASY TO MAINTAIN . . . paint reaches entire surface.
4. SELF-CLEANING, no sharp corners to clog.
5. SAFE footing at all times with twisted cross bar.

Write for complete specifications

BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2072 Farmers Bank Building
Pittsburgh 22, Pa.

BLAW-KNOX *Electroforged*® STEEL GRATING AND STAIR TREADS



If you have a PUMPING PROBLEM

. . . ask for VIKING PUMP ENGINEERING

You'll find Viking engineers don't need to compromise on size or style of Rotary pump to fit your needs. Probably there is one ready to adopt to your problem. They have a wealth of experience to draw from to help solve your pumping problems. Forty years of building, designing and applying Viking's gear-within-a-gear principle has developed the most complete line of all rotary pumps and it places them in a position to solve your pumping problem best.

Ask Viking for the answer to your pumping needs. Send for free bulletin 51SG today.

VIKING
AN HONORED NAME IN PUMPING

See Our Catalog in SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

Lubrication **545**
Mail coupon on page 51 for free booklet "11 Ways to Cut Production Costs" and data on the new Alemite Oil-Mist System. Alemite, Div. of Stewart-Warner. See page 51.

Lubricants **546**
Ask for more information about Rubilene—top quality oil providing uniform, trouble-free lubrication over long periods of use. Sinclair Refining Co. See page 22, 23.

Lubricants **547**
Consult the Standard Oil lubrication specialist for facts and service records of Nonpareil turbine oil and Stanolith greases. Standard Oil Co. (Indiana). See page 35, 36.

Lubricant **548**
Send for Bulletin No. 506 and free testing sample of Non-Fluid Oil for positive bearing protection. New York & New Jersey Lubricant Co. See page 152.

MATERIALS OF CONSTRUCTION

Nickel Alloy **549**
Write for your free copy of Technical Bulletin T-5, "Engineering Properties of Monel and 'R' Monel." The International Nickel Co., Inc. See page 102.

MECHANICAL POWER TRANSMISSION

V-Belts **550**
When you buy V-belts, be sure to specify Gates Vulco Rope—gives you the money-saving "concave side" feature. Write for details. The Gates Rubber Co. See page 113.

V-Belts **551**
See advertisement for typical examples of Goodrich Grommet Belts. Last 20 to 50% longer than other types, yet cost no more. The B. F. Goodrich Co., Industrial Products Div. See pages 15, 16, 17 & 18.

Chains **552**
Consult your nearest Union Chain Distributor for your chain needs. Made in all types of steel for top efficiency and minimum cost. Union Chain & Mfg. Co. See page 42, 43.

PACKAGED STEAM GENERATORS

Generator **553**
Dependable, quick steaming unit. Minimum installation expense, economical operation. Write for latest free bulletin. Ames Iron Works. See page 159.

Generators **554**
Send coupon on page 101 for complete details on the Continental Packaged Steam Generator equipped with dependable controls of finest quality for fully automatic operation. Boiler Engineering & Supply Co. See page 101.

Generators **555**
Check the important features of Preferred Unit Steam Generators that assure efficient economical service for an average of 25 years. Write for Bulletin 1000. Preferred Utilities Mfg. Corp. See page 37.

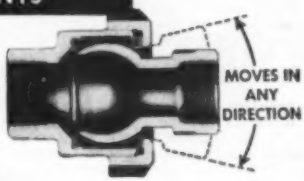
(Continued on page 140)

BARCO *Flexible* JOINTS *to meet* INDUSTRY'S NEEDS

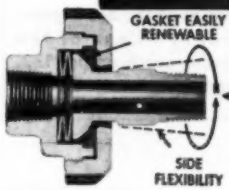
● Wherever piping connections must move, look to BARCO for the ANSWER! Whatever your problem, Barco, invariably, can solve it BETTER, EASIER, and QUICKER with a tested and proven joint right out of the standard Barco line. This is because Barco builds a truly complete line of flexible ball, swivel, swing, and revolving joints—*there is a size and type for every purpose!* Submit your problem; ask for recommendations—Barco is at your service.

FLEXIBLE BALL JOINTS

"One joint does the work of two or more!"—because it moves in any direction. Standard the world over where low cost, leakproof movable joints are needed in piping handling steam, air, water, oil, gas, or chemicals. Many models available. Up to 40° side flexibility *plus* 360° swivel action. Also used to facilitate quick connection of piping, overcome misalignment. Pressures to 6,000 psi; temperatures to 1,000° F. 15 different sizes, ¼" to 12". *Bulletin 215.*

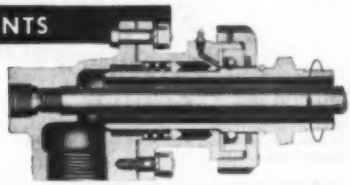


ROTARY SWIVEL JOINTS



Exclusive angular motion prevents binding—only Barco offers this important advantage! Widely used for making compact, low torque swivel connections to reciprocating or rotating parts on platen presses, tire molds, oil burners. Easy to position piping accurately—no sagging, flopping lines. Leakproof, safe—pressure or vacuum. Ratings as high as 600°F., 3,000 psi (hydraulic). Sizes, ¾" to 2"; angle or straight. *Bulletin 265.*

REVOLVING JOINTS



Minimum roll "drag" cuts power costs—up to 50% savings! Note wide spacing between bearings; inherent low torque little affected by pressure, speed, or temperature. Parts easily accessible. Light running action minimizes wear, permits free-floating installation. No adjusting necessary—long, leakproof service. Ratings to 250 psi (steam); 450°F. Single flow or syphon styles. Sizes ½" to 3". Wide choice of models; speeds to as high as 2,500 RPM. *Bulletin 300.*

Send for
NEW BULLETINS
For detailed information on Barco Joints, write for latest literature:
Bulletin 215:
"Barco Ball Joints."
Bulletin 265:
"Barco Swivel Joints."
Bulletin 300:
"Barco Revolving Joints."
Bulletin:
"Barco Swing Joints."

Worldwide Sales and Service
BARCO
MANUFACTURING CO.
1831M Winnemac Ave., Chicago 40, Illinois
In Canada: The Holden Co., Ltd.

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

Readers' guide to advertised products

(Continued from page 139)

Generator **556**
Write for Catalog 1218 that gives you the entire story of the Powermaster steam generator. Orr & Sembower, Inc. See page 45.

Generator **557**
Write for Bulletin SB24B for additional facts on the Erie City "VL" Steam Generator, fired with coal, oil or gas. Erie City Iron Works. See page 111.

Generators **558**
Write for Catalog 302 with complete details on Superior Steam Generators available in 18 sizes. Superior Combustion Industries, Inc. See page 132.

Boilers **559**
Mail coupon on page 142 for catalog with full information on Johnston "packaged" steam boilers—fully automatic, 60 to 500 hp plus ample overload. Johnson Brothers, Inc. See page 142.

PACKINGS & GASKETS

Gaskets **560**
Accurate reproduction of dimensions assures perfect fit, long trouble-free service of heat exchanger gaskets. Ask for estimates on standard and special shapes. United States Gasket Co. See page 32.

Packings **561**
Consult your R/M distributor for your packing or gasket needs. Or write for R/M Packing Catalog. Raybestos-Manhattan, Inc., Packing Div. See page 58.

Packing **562**
Write today for full particulars on Palmetto Palco and the full line of Palmetto packings for all industry. Greene, Tweed & Co. See page 154.

PIPE AND FITTINGS

Flexible Joints **563**
Write for Bulletins 215, 265 and 300 for detailed information on Barco ball, swivel, revolving and swing joints. There is a size and type for every purpose. Barco Mfg. Co. See page 139.

Flexible Metal Hose **564**
Write for Bulletins SS-50 and CC-300 for data on flexible connectors for almost any liquid, gas or semi-solid. American Metal Hose Branch, The American Brass Co. See page 131.

Expansion Joints **565**
You need fewer joints and less maintenance with Yarway gun-pakt slip-type expansion joints. Write for Bulletin EJ-1912 with complete story. Yarnall-Waring Co. See page 31.

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on pg. 133. Mail today—postage-free!

PUMPS

Flexible Metal Hose **566**
Atlantic metal hose survives most extreme conditions. Seamless or interlocking, in bronze, steel, stainless steel, monel. Write for Catalog 500. Atlantic Metal Hose Co., Inc. See page 140.

Pumps **567**
Consult the Weinman centrifugal specialist for complete information on Weinman pumps that assure uninterrupted service. Write today. The Weinman Pump Mfg. Co. See page 108.

Pumps **568**
Write for Bulletin S-204 for complete information on Warren-Quimby Screw Pumps. Warren Steam Pump Co., Inc. See page 40.

Pumps **569**
Ask Viking for the answer to your pumping needs. Send for free Bulletin 51SG today. Viking Pump Co. See page 138.

Pumps **570**
General information on Vertical Tur-

FLEXIBLE METAL HOSE
Insured
FOR YOUR PROTECTION
"TEST HOSE TO FOUR TIMES SPECIFICATIONS" is standard procedure with every length of Atlantic flexible metal hose.
17 rigorous torture tests for flexibility, bursting pressure and uniformity reveal any material or fabricating fault. That's why Atlantic flexible metal hose is Job Tested & Guaranteed to Do Its Job!
Seamless & Interlocking Hose. Bronze, steel, stainless steel. ¼"-36" I.D. with proper fittings.
Write for Catalog 500
See Our Catalog in Sweet's File for Product Designers
ATLANTIC METAL HOSE CO., INC.
124 West 64th St., New York 23, N. Y.

no coddling
pul-leeze
STACON TEMPERATURE REGULATOR*
*Patented
You can install a Farris Stacon Temperature Regulator and forget all about it. You know it will operate positively and accurately under all conditions and at all times.
The Farris Stacon Temperature Regulator is dirt-proof, trouble-free. It operates with unheard of accuracy—to within plus or minus 1 deg. And that's not just under ideal circumstances. It functions with identical accuracy in the worst possible surroundings—provides air-operated sensitivity at self-operated cost.
Here's why: In patented Stacon Regulators, there are no packing glands to leak or bind. The liquid in the bulb flashes to vapor in the power bellows, providing hair-trigger response to move the valve disc.
You'll want complete details on this accurate and economical temperature regulator. Write for Stacon Bulletin 50-100.
Farris Stacon Corporation
511 COMMERCIAL AVE. PALISADES PARK, N. J.

bine Pumps. Worthington Pump & Machinery Corp., Vertical Turbine Pump Div. See page 55.

Pumps **571**
Consult your I-R engineer to determine if you have any pumps in service that can profitably be replaced by more modern, efficient I-R unit. Ingersoll-Rand. See page 29.

REFRACTORIES

Refractory **572**
Consult your B&W Field Engineer for additional information on Kaocast, the 3000F refractory castable. Insures lower installation costs, faster repairs and longer service life. The Babcock & Wilcox Co., Refractories Div. See page 33.

Insulating Cement **573**
Advertisement lists 7 reasons for using Stic-Tite plastic insulation. Send coupon for bulletin and free sample. Refractory & Insulation Corp. See page 127.

SOOT BLOWERS & TUBE CLEANERS

Tube Expanders **574**
Write for complete information on Wiedeke Series 900 tube expanders for tubes as small as 15/16" inside diameter. The Gustav Wiedeke Co. See page 157.

Tube Cleaners **575**
Write for informative bulletins on tube cleaners and expanders, also Wilson-Dunton safety bolt for pulling oil burners with pressure on. Thomas C. Wilson, Inc. See page 136.

STEAM SPECIALTIES

Traps **576**
Write for new Bulletin 455 with full information on Sarco FT Traps for unit heaters. Sarco Co., Inc. See page 56.

Fluid Controls **577**
Write for bulletins on this complete line of automatic equipment to control steam from boiler outlet to return inlet. Illinois Engineering Co. See page 151.

Traps **578**
Hoffman inverted bucket traps are adjustable to a wide choice of pressures, simply by changing valve seats. Send for full information. Hoffman Specialty Co. See page 34.

Traps & Strainers **579**
More than 200 industrial distributors sell Yarway traps and strainers. See your nearest one today. For name, and free 24-page Steam Trap Book, write Yarnall-Waring Co. See page 64.

(Continued on page 142)

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on pg. 133. Mail today—postage-free!

breaks all records

. . . THE AIRETOOL TUBE ROLLING CONTROL

It's amazing that any tool which rolls tubes with such uncanny accuracy can do it with such speed. Yet, it's a fact that wherever the AIRETOOL tube rolling control has been tested against ordinary tube rolling methods, new performance records have been set. Tube bundles can now be perfectly rolled in half the time formerly required.

This increased speed and accuracy is quickly translated into greater production . . . less downtime . . . easier work. Before you tackle your next tube rolling job, study the performance record of the AIRETOOL Tube Rolling Control. Write for descriptive literature to The AIRETOOL Mfg. Co., 318 S. Center St., Springfield, Ohio.

here's how it operates

An AIRETOOL ball-bearing type expander is inserted into the tube to be rolled. A powerful motor drives the expander and when the desired degree of expansion has been reached, the control instantaneously cuts off the power. This is accomplished by setting a dial calibrated for the tube size and type to be rolled. The expander is then removed and inserted into the next tube to be rolled. Unfailing mechanical control replaces human judgment and fast, perfect tube rolling is assured.

There's an AIRETOOL Tube Cleaner and Tube Expander for every type of Tubular Construction

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES: New York, Philadelphia, Chicago, Houston, Tulsa, Baton Rouge

Readers' guide to advertised products

(Continued from page 141)

Traps **580**
Write for Catalog 751 with complete data on Nicholson expansion steam traps. W. H. Nicholson & Co. See page 126.

Traps **581**
Write for copy of Armstrong Steam Trap Book—tells all about Armstrong Blast and Standard Traps—where to use them and how to select and install them. Armstrong Machine Works. See page 2.

Traps **582**
Write for Catalog 600 with complete specifications and application data on "AIRXPEL" steam traps. Wright-Austin Co. See page 116.

Traps **583**
Clark Duo-Step Leverage gives double the drainage capacity of old-fashioned traps. Write for additional information. The Clark Mfg. Co. See page 21.

THERMAL INSULATION

Insulation **584**
Consult B-H with your industrial heat control problem. Send coupon on page 107 for data on the complete line of Black Rockwool insulating materials. Baldwin-Hill Co. See page 107.

TOOLS

Snatch Blocks **585**
For heavy hoisting specify WECO snatch blocks for greatest service and longest life. Write for bulletin. Well Equipment Mfg. Corp. See page 142.

Pipe Tools **586**
Toledo pipe tools and power pipe machines designed for easy handling, faster cutting . . . in complete range of capacities. Write for catalog. The Toledo Pipe Threading Machine Co. See page 150.

Tube Rolling Control **587**
Before you tackle your next tube rolling job, study the performance record of Airetool Tube Rolling Control. Write for descriptive literature. The Airetool Mfg. Co. See page 141.

Tools **588**
Send 10c today for 68-page catalog of Proto Tools. Plomb Tool Co. See page 6.

Blower Suction Cleaner **589**
Write for complete information on the Clements-Cadillac portable blower-suction cleaner. 5 Models with complete attachments. Clements Mfg. Co. See page 164.

TURBINES

Turbines **590**
Many unusual combinations have been developed by Terry to meet out-of-the-ordinary requirements in special purpose turbines up to 2000 hp. Write for data. The Terry Steam Turbine Co. See page 50.

Turbines **591**
General information on steam turbines. Worthington Pump & Machinery Corp., Steam Turbine Div. See page 57

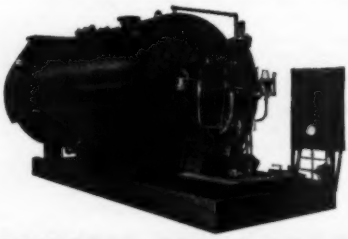
VALVES

Valves **592**
Dependable quality Crane valves insure low maintenance costs. Ask your Crane representative for a demonstration or write for full details. Crane Co. See page 44.

Valves **593**
Darling gate valves are made in wide range of sizes, types and constructions for every need. Ask for Darling Cast Steel Valve Bulletin. Darling Valve & Mfg. Co. See page 155.

Valves **594**
Write for illustrated fact-sheet on List 960 Chapman forged gate valves. The Chapman Valve Mfg. Co. See page 54.

Valves **595**
Write for bulletin that gives full information on these duplex units which meet all code requirements for boiler-



"PACKAGED" STEAM BOILERS

Completely Equipped and tested at factory.
Fully Automatic. Heavy Oil, No. 6
60 to 500 Horsepower plus ample overload.
Efficiency and **Capacity** guaranteed.
Prompt Service by factory trained engineers always available.

JOHNSTON BROTHERS, INC.

JOHNSTON BROTHERS, INC.
Ferrysburg, Michigan
Please mail catalog with full information.
NAME .....
COMPANY .....
ADDRESS .....

WECO DROP-SIDE SNATCH BLOCKS

RUGGED — TOUGH
EASY TO HANDLE

Forged steel hook and sheave . . . induction hardened extra heavy sheave pin . . . 3/8" steel plate sides . . . self-lubricated "Super Oilite" bearing give WECO SNATCH BLOCKS strength for heavy hoisting, and durability for long life.

The patented "Drop Side" makes it easy to string and unstring the block. Instead of the usual "needle threading" procedure just remove the wing nut, raise side, insert line, drop the side, and replace the nut.

Specify WECO SNATCH BLOCKS for greatest service and longest life. Write for bulletin.

WELL EQUIPMENT MFG. CORP.
HOUSTON 1, TEXAS
WECO

blow-off service. Everlasting Valve Co. See page 128.

Valves **596**
Send coupon on page 4 for Bulletin 491 on Edward Instrument valves. Edward Valves, Inc., Subs. of Rockwell Mfg. Co. See page 4.

Valves **597**
For accurate pressure regulation and trouble-free service write for complete information on the Leslie Class AWG Reducing Valve. Leslie Co. See page 162.

Valves **598**
Write for Bulletins S-1A and S-2 with technical data on Golden-Anderson automatic triple and single acting non-return valves. Golden-Anderson Valve Specialty Co. See page 145.

Valves **599**
Think of Aloyco valves first if your plant deals with corrosion or must guard everywhere against product contamination. Ask for specialized engineering assistance. Alloy Steel Products Co. Inc. See page 53.

Valves **600**
Write for complete information on B&J orifice valve Type H that simplifies setting, readjusting and reading. Barnes & Jones Inc. See page 118.

Valves **601**
The W. S. Rockwell Valve News describes latest developments in control valves for air, gases, liquids & semi-solids. Write to receive copies monthly. W. S. Rockwell Co. See page 156.

Valves **602**
For new installations, for all replacements, let Jenkins Diamond be your guide to lasting valve economy. Write for details. Jenkins Bros. See page 9.

Valves **603**
See advertisement that lists 4 ways to cut pump repairs with Sims valves. Send for free catalog. Sims Pump Valve Co., Inc. See page 148.

WATER TREATMENT

Water Treatment **604**
New bulletin gives full details on the Bird-Archer Amine Treatment. Contains case histories that prove its successful application in many plants. Write for your copy today. The Bird-Archer Co. See page 129.

Automatic Control **605**
For design and production of automatic panel control of your water processing. Call Belco the next time you consider equipment for removal of water impurities. Belco Industrial Equipment Div., Inc. See page 124.

Flo-Klean Filter **606**
Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in quick time. Write today or send coupon for full data. Cuno Engineering Corp. See page 123.

Water Softener **607**
Write for Publication 4520 with complete details on Cochrane Zeolite Water Softeners. Cochrane Corp. See page 115.

Water Treatment **608**
Write for your free copy of "The Betz Indicator," a monthly publication devoted to general discussion of all water problems. W. H. & L. D. Betz. See page 11.

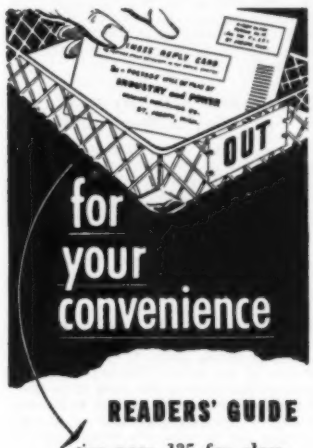
Waste Treatment **609**
Write for free booklet "Four Ways To Economize on Industrial Wastes", a factual treatise with much useful information. Gilbert Associates, Inc. See page 167.

Water Treatment **610**
Write for Bull. DM with complete details on H&T's ion exchange Demineralizing Units. . .process insures purest water. Hungerford & Terry, Inc. See page 165.

Water Conditioning **611**
General information on Worthington Hot-Z deaerating type water conditioning system. Worthington Pump & Machinery Corp., Water Treating Section. See page 63.

MISCELLANEOUS

Misc. Equipment **612**
Manufacturers and distributors of plumbing, heating, industrial and refrigeration supplies and equipment. More than 33,000 products. Hajoca Corp. See page 164.



READERS' GUIDE

See page 135 for classified list of literature offered by advertisers.

You'll find it so convenient to use one of the postcards on page 133 for requesting literature or more information about advertised products. Just list the paragraph key numbers for material you want and drop the card in your OUT basket. Your inquiry will be processed quickly and accurately.

HENSZEY

PACKET-TYPE *Automatic*
CONTINUOUS BLOWDOWN

- Prevents PRIMING
- Prevents FOAMING
- Prevents SLUDGE
- Prevents SCALE

(with simple chemical treatment)

This compact self-contained unit is completely assembled. Can be installed by your own men in hours. It provides completely automatic control of boiler water concentration regardless of variations in boiler load. This is accomplished WITHOUT HEAT LOSS. Maintain clean efficient boilers for substantial savings in fuel, equipment and manpower.

Also...
Standardized or special units for ALL CAPACITIES.

HENSZEY

Consult your nearest HENSZEY Representative for FREE Blowdown Chart or write to

HENSZEY COMPANY
Dept. A11 • Watertown, Wis.

CONTINUOUS BLOWDOWN and BOILER PLANT SPECIALTIES
Boiler Feed Regulators • Distillation Systems • Heat Exchangers • Feed Water Meters
Flow Indicators • Proportioning Valves
Also MILK EVAPORATORS and PREHEATERS

MIKRO-PULVERIZER
for granular or fine grinds

A simple change in our MIKRO-PULVERIZER has produced outstanding results, especially in the handling of heat-sensitive materials. Altho this project is still in the development stage, we know that on some materials it means . . .

25% reduction in temperature rise
25% reduction in H.P. consumption
OR—in lieu of H.P. savings—
a 30-50% increase in production

Right now, you can help yourself by letting us try this new grinding method on *your own material* in the MIKRO Laboratory. Test will cost you nothing, but it may solve your problem.

INVESTIGATE this opportunity today.

Visit the MIKRO Exhibit
Booths 300-302
23rd Exposition of Chemical Industries
Grand Central Palace, New York, N. Y.
Nov. 26 to Dec. 1, 1951

PULVERIZING MACHINERY COMPANY
44 Chatham Road Summit, New Jersey

MIKRO-PULVERIZER
MIKRO-ATOMIZER
Also Makers of the MIKRO-COLLECTOR

PRESERVE OUR HERITAGE: FAITH, FREEDOM & INCENTIVE

New equipment and developments

(Continued from page 130)

ically closes or opens the contact when it is operated, affording direct control over starting and stopping. This reduces maintenance by eliminating intermediate devices (circuit coils, magnetic contacts), which might fail or malfunction. It also reduces pitting and erosion on contact tips by eliminating chattering or misstarts. A time-delay fuse connected directly in the line protects the motor circuit from overload. This time-delay feature enables the fuse to carry harmless overloads and starting circuit inrushes, as well as providing motor-running and branch circuit over-current protection.

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly

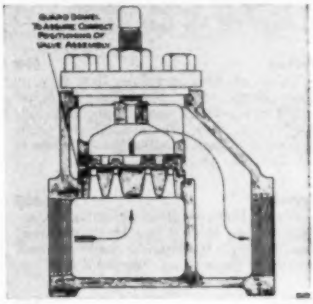
36—*Magnetic drive controller gives precision speeds*

Precise control of speed with no maintenance problems is offered in the Electric Machinery Mfg. Company's Regutron magnetic amplifier control. This controller is used with an electromagnetic torque transmitting device, which gives variable speed output when applied in combination with a constant speed motor. The unit eliminates all the complicated electronic circuits. A

simple saturable core reactor amplifier system using non-moving parts accomplishes the precise, stepless control of speed to within ± 0.5 per cent of the deserved speed. This hairline sensitivity is obtained through a current amplification ratio of approximately 20,000 to 1. All components are reliable, time-proven devices, and conservatively rated parts should last for years with little change in characteristics. The drives are built in ratings of 25 hp and higher in the usual motor speeds.

37—*Check valve protects air and gas compressors*

The Pennsylvania Pump and Compressor Co. air check valve was originally conceived to eliminate fear of damage to a gas or air compressor. It absolutely safeguards against the forgetfulness of operating personnel to open a valve when starting up.



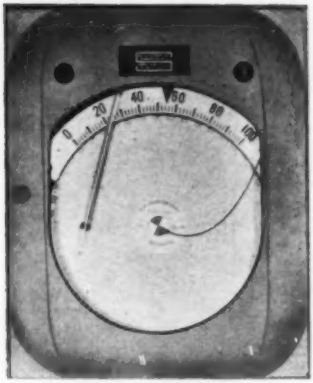
This valve dispenses with customary arrangement of stop, safety and globe valves, (2) prevents leakage of pressure through the compressor during the "off" cycle, (3) dampens pipe line pulsations, and (4) permits repairs without shutting down the system where more than one compressor is on the line.

38—*Product provides rust proofing without coatings*

An economical method of preventing rust and corrosion of metal parts is provided by "VPI" crystals, a slightly volatile amine nitrite now being made available to industry by the Shell Oil Co. This volatile corrosion inhibitor is used in protecting metal parts, assemblies, instruments and finished products during shipment, storage and through various processing steps. Being slightly volatile at atmospheric temperatures, VPI gives off vapors, which are carried by convection and diffusion to all surfaces of the metal, where they condense to provide a thin protective layer. It can be applied by placing the powder-like substance in a package that encloses the parts to be protected, by blowing into the area to be protected, by mixing with water or alcohol solution and covering the metal parts in tote boxes. An unusual characteristic of VPI is that corrosion, at any advanced stage, will be arrested.

39—*Instrument records smoke density*

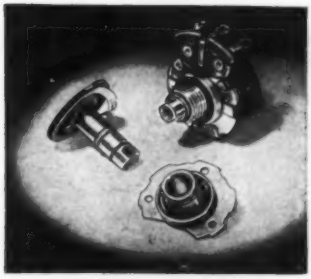
This SR-6L smoke indicator-recorder is a quick-acting, sensitive null balance potentiometer developed primarily as an instrument for use with various smoke indicators manufactured by Ess Instrument Co. It is also used with their turbidity, dust and other "electric eye" applications. Instrument is housed in a steel case with molded bakelite door and is provided with a large



pointer indicator and fluorescent illumination. The 12 in. chart makes a 24 hr record of variations of measured variables. Warning signals at any desired limits may be added.

40—*Waterproof control withstands 6 ft water head*

Series of waterproof controls, announced by Clarostat Mfg. Co., Inc., are available in a wide range of resistances and wattages. A rubber "O" ring is incorporated on the shaft creating a water tight seal, which will withstand pressure equivalent to a 6 ft head



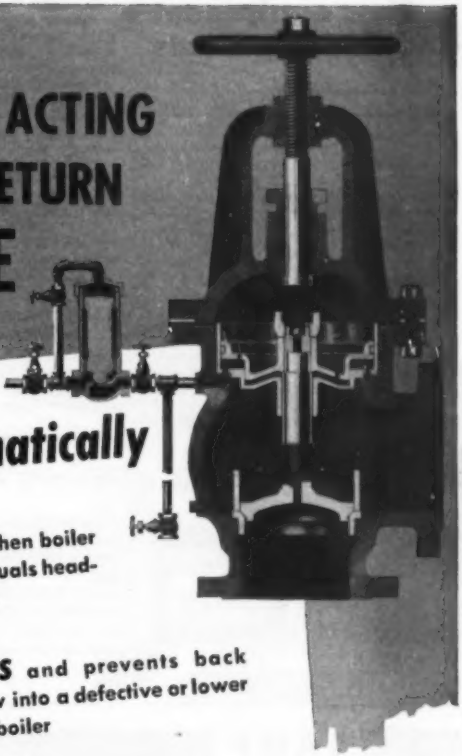
of water. A similar rubber "O" ring is employed on the mounting surface of the bushing to perform the same function as the shaft "O" ring seal. Rings are a rubber compound of special design to meet extreme temperature requirements and are resistant to oils and greases.

41—*Heat transfer units perform at 800 F*

A line of liquid phase heat transfer equipment to operate at temperatures up to 800 F has been developed by the American Hydrotherm Corp. The equipment is offered as individual components adaptable to large industrial requirements, or as tailored package units for smaller installations. Coal, gas or oil fired boilers with capacities up to 20,000,000, Btu per hr are especially designed for high circulation temperatures and for high flow velocity to avoid overheating the liquid transfer medium. Special centrifugal pumps are rated up to 1600 gpm. Package units, mounted on a common frame, utilize

(Continued on page 146)

This
TRIPLE ACTING
NON-RETURN
VALVE



Automatically

✓ **Opens** when boiler pressure equals header pressure

✓ **Isolates** and prevents back steam flow into a defective or lower steaming boiler

✓ **Prevents** boiler steam flow when steam line or header is ruptured.

GOLDEN-ANDERSON

also makes this Single-Acting Non-Return Valve

which will automatically open to cut-in the boiler when its pressure equals the header pressure and automatically close to isolate the boiler when its pressure decreases.

Bulletins S-1A and S-2 contain complete technical data.

Golden Anderson Valve Specialty Company

2095 KEENAN BUILDING • PITTSBURGH 22, PA.

New equipment and developments

(Continued from page 145)

electric heaters with capacities from 3 to 75 kw, or gas heaters with ratings of 250,000 to 1,000,000 Btu per hr, and may be adapted for oil firing. Circulating pumps for these units come in sizes of 1-½ to 120 gpm. All components are designed and constructed to perform at any flow temperature or speed.

42—*Portable unit records alternating current usage*

A trouble-shooting combination, the TAG recording ammeter used portably with a Weston clamp-ammeter unit model 663, type AIR-A2R, is now available from the Taglabue Instruments Div., Weston Electrical Instrument Corp. for measuring and recording alternating current without breaking the circuit. Designed to check on and make a permanent usage record of alternating current and circuit reactions, this combination can be employed to cover all operations within a power, manufacturing or processing plant as an aid in preventing wasted power, time, labor and money. Records obtained can reveal proper or improper handling of plant equipment, detect unwarranted use of power and discover unnecessary waste. To obtain data on current consumption under peak load conditions, engineers can apply the clamp sensing element, which transmits findings to the recorder. After the record is made, the chart can be removed from the recorder for permanent filing. Compact, convenient and safe it can be used with an extension cable several hundred feet long to connect to the recorder. The laminated clamping jaws are insulated with heavy rubber sleeve, which withstands a breakdown test of 500 v.

43—*Extinguish fires with dry chemical*

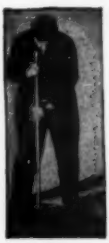
New 20 and 30 lb capacity light weight, stainless steel, dry chemical fire extinguishers have been announced by the Buffalo Fire Appliance Corp. Advantages of the new

fire extinguisher are its extreme light weight and maneuverability, which allow the operator to reach the seat of the fire without any lost motion. It has finger tip control, and shoots a chemical heat insulating cloud up to 20 ft. The dry chemical used produces 1100 times its volume in non-toxic, flame-killing gas on contact with flame.

(Continued on page 148)

TO REQUEST ADDITIONAL FREE DATA

Each paragraph in this section is numbered —beginning with number 1. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out and mail this card. Our Reader Service Department will handle your request promptly



TAMP
←
TRUCK OVER
→
NO WAIT FOR DRYING

HERE'S THE QUICKEST, BEST WAY TO
PATCH BROKEN FLOORS

Use durable INSTANT USE . . . a tough plastic material which you simply shovel into hole—tamp—and run traffic over immediately. Tough INSTANT-USE is ideal for repairing cracks and breaks due to relocating machines . . . or for complete overlays. NOTE: Plasticizer makes INSTANT-USE easy to scoop out of container . . . easy to level, to tamp, to use! *There's a Flexrock material for every floor condition—oil, acid, wet, dry! Tell us your problem!*

MAIL COUPON for TRIAL OFFER and HANDBOOK OF BUILDING MAINTENANCE

INSTANT-USE

FLEXROCK COMPANY
3605 Filbert St., Phila. 4, Pa.

Offices in Principal Cities

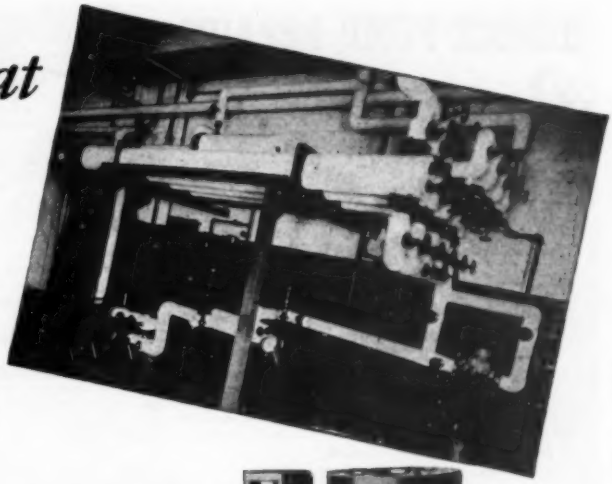
Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN and HAND BOOK OF BUILDING MAINTENANCE—no obligation. (Clip and attach Coupon to Co. letterhead).

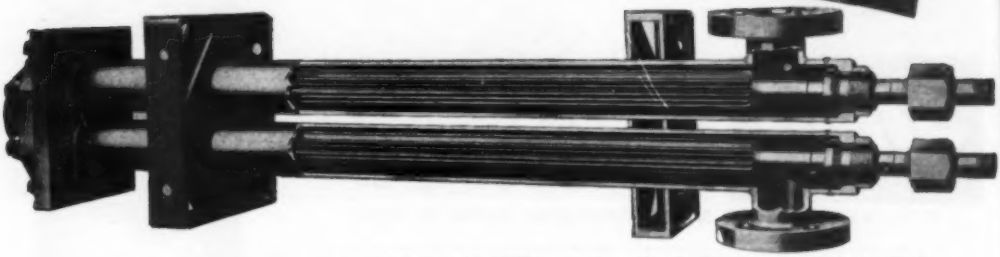
Name .....
Company .....
Address .....

"LIQUIDS WORTH STORING ARE WORTH MEASURING" WITH A
LIQUIDOMETER
Tank Gauge
WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

Isn't this what you want in a **FUEL OIL HEATER?**





SIMPLE — Just a pipe within a pipe—that's the principle of the Twin G-Fin Section. The G-Fin inner pipe, through which the steam passes, has longitudinal fins to provide greater surface for transfer of heat to the oil flowing through the outer pipe.

COMPACT — The longitudinal G-Fins provide at least six times as much heat transfer surface as bare tubes . . . the result: the Twin G-Fin unit has fewer tubes than any other type of heater.

LEAK PROOF — Leakage between steam and oil cannot occur because there are no internal joints.

READILY INSTALLED — The Twin G-Fin Section is easily handled, and can be placed close against a wall, ceiling or floor . . . wherever most convenient. Movable supports further assist convenient installation.

FLEXIBLE CAPACITY — These units are standard and interchangeable. They may be arranged in series or parallel; and at partial loads, sections may be cut in and out to maintain constant oil temperature.

EASY TO CLEAN — The G-Fin heating elements or pipes may be completely removed from the shells for cleaning, without disturbing the oil connections. No special tools are required.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

GRISCOM-RUSSELL
TWIN G-FIN SECTION
The Universal Heat Exchanger

REDUCE PUMP REPAIRS 4 WAYS

1. **Prevent STEM and SPRING breakage.** Exclusive double shock absorber built into Sims valves stops impact shock.
2. **Stop wear.** Long guide of ROTATOR prevents cocking of DISC—assures even opening.
3. **Keep seating surfaces leak free.** Only Sims guarantees the valve DISC will rotate every time it lifts.
4. **Stop valve slam and knock.** Quiet operation is gained by cushioning moving parts and cutting resistance to flow through the SEAT ... with patented **inclined ribs.** This reduction of resistance allows cylinders to fill completely. Pump capacity is increased 20%.

Sims valves are made in sizes from 2¾" to 15¼" to fit any reciprocating pump. Valves supplied ready to install—cast in individual units or in complete plates.

SIMS PUMP VALVE CO., INC.

New catalog shows how Sims valves fit any pump—how they work—efficiency and comparison charts. Send for your free copy today.

145 HUDSON ST., NEW YORK 13, N. Y. • M & M BLDG., HOUSTON, TEXAS

Adequately Sized for Peak Efficiency!

Pritchard Quality Cooling Towers

You can depend on Pritchard Quality Cooling Towers to get the job done more efficiently...more economically. Pritchard Towers are guaranteed to meet your peak loads as well as normal needs because they're *adequately* sized and *thoroughly* engineered. Quality materials assure longer life... and trouble-free service. Let Pritchard skill and experience go to work for you on your next cooling tower job!

Write for Bulletins!

Cooling Towers
Gas & Air Treating
Specialized Heat Exchangers

QUALITY Specialized Process EQUIPMENT

J.F. Pritchard & Co.
EQUIPMENT DIVISION
Dept. No. 204 908 Grand Ave., Kansas City 6, Mo.

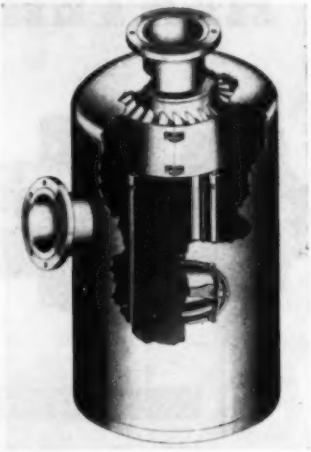
Home Offices: CHICAGO • HOUSTON • NEW YORK • PITTSBURGH
TULSA • ST. LOUIS • Representatives in Principal Cities from Coast to Coast

New equipment and developments

(Continued from page 146)

44—*Purifier delivers clean vapors*

A new receiver-type purifier developed by V. D. Anderson Co. is claimed by the manufacturer to remove practically all destructive entrainment from vapor lines. In steam installations the unit is guaranteed to purify steam having a concentration of 1000 ppm solids to less than 0.5 ppm solids. This unit, an addition to Anderson's Hi-eF purifier



line, has applications including protection of turbines and steam engines, use in exhaust steam installations where entrainment removal is necessary, and removal of condensate from compressed air systems. A self-cleaning action and lack of moving parts are other advantages claimed. Units are made in nominal size from 4 to 16 in.

45—*Scrubber features two-stage separation*

A dry scrubber purifier with two-stage separation is announced by The Centrifix Corp. Said to be capable of delivering vapor containing 1.0 ppm total solids or less, the unit provides internal upflow operation in pressure vessels such as steam drums. Primary stage separation is accomplished by means of a rectangular-shaped anti-turbulence shield, which blocks direct contact of turbulent liquids and spray with the secondary separation chamber behind the shield. Secondary separation is accomplished by means of either upflow or downflow purifiers enclosed within the anti-turbulence shield. The purifier achieves separation efficiencies of 99.9 per cent or better, by utilizing the motion of the vapor as a means of separating moisture and entrainment. Due to the non-restrictive design using tangentially-located tuyere vanes to create high-velocity centrifugal action, the dry scrubber purifier is said to perform with almost no pressure loss. The unit is designed with no filter elements or moving parts.

Nipple that failed after one year in main condensate line.
Corrosion of threaded area caused leakage in return line.
these parts were destroyed by RLC*
Carbonic acid corrosion eats right through cast iron elbow.
Nipple shows characteristic pitting due to dissolved oxygen.

prevent Return Line Corrosion with Dearborn Formula 700 or 702

These destroyed parts were the victims of *return line corrosion.* If your maintenance costs are high because leaking or clogged return lines require replacement—if rusty condensate is coming back to your boilers—then it will pay you to use Dearborn Formula 700 or 702.

Return line corrosion is caused by oxygen and carbon dioxide. It can be effectively controlled thru the easy, inexpensive application of either the neutralizing amine-type treatment (Formula 700) or Dearborn's new filming-type amine treatment (Formula 702).

Your Dearborn Engineer is prepared to make specific recommendations on the use of Dearborn Formula 700 or 702 in your plant.

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois

NOTE: Dearborn holds the basic patent (U.S. Pat. 2400543) for the use of filming amines for treating water.

WRITE FOR THIS BULLETIN

Write for Bulletin 5013 which outlines causes of return line corrosion and describes how it can be controlled by Dearborn Formula 700 or 702.

Dearborn Chemical Company Dept. INP
Merchandise Mart Plaza, Chicago 54, Ill.

( ) Send a copy of Bulletin 5013
( ) Have a Dearborn Engineer call

Name.....

Position.....

Company.....

Address.....

City.....Zone....State.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

THREAD PIPE *Faster*
BY HAND OR MACHINE
Cut Costs with **TOLEDO**

Good tools help you speed up pipe fitting and beat high costs!

Start the job *right* with genuine TOLEDO Pipe Tools and Power Pipe Machines—tools you can trust for top-performance and top-speed production! Each Toledo designed for *easy handling, faster cutting* . . . in a complete range of capacities. Hand Tools, all pipe sizes, ⅛″ to 12″ and ¼″ to 1″ bolts. Power pipe machines, up to 2″ and 4″ capacity. Your mechanics will do better work, faster and easier with time-proven Toledos —the choice of experienced hands for nearly half-a-century. Write for catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

Light weight, low cost! Toledo No. 1R Threader, 1″ to 2″ pipe.

For close corner work, Toledo No. 11 Ratchet Threader, ½″ to 1¼″ pipe.

Toledo No. 999 2″ Power Pipe Machine, wheel or knife cut-off.

RELY ON THE LEADER

TOLEDO

PIPE TOOLS . . . POWER PIPE MACHINES . . . POWER DRIVES

New bulletins and catalogs

(Continued from page 34)

rubber core, and diagonal expansion types are all described in 8-page bulletin. Gives complete service recommendations for each type, lists standard sizes available, and gives complete packaging specifications on all types. Raybestos-Manhattan, Inc., Packing Div.

Packing, Packing Tools **259**

Anti-frictional, self-lubricating, flexible metallic packing, along with flexible packing tools are illustrated and described in 4-page bulletin 436. Discusses types and styles and suggests recommended uses. Rotary mechanical seals also are covered briefly. Gives bulletin numbers for more detailed information. Durametallic Corp.

PIPE AND FITTINGS

Swing Joints **260**

Features of joints which provide swivel or slow continuous, rotating movement without side flexibility are illustrated and described in 4-page bulletin. Contains detailed performance data, dimensions and installation combinations. Can handle air, gas, water, oil and most chemicals according to the booklet. Barco Mfg. Co.

Nickel Pipe **261**

Technical bulletin T17 constains 27 pages of information on nickel and high nickel alloy pipe and tubing. Illustrated by drawings and photographs. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures and other data. The International Nickel Co., Inc.

HOW TO REQUEST FREE BULLETINS

Each paragraph in this section is numbered —beginning with number 200. This is the "key" number which should be inserted on the return post card on page 133. Just fill in, tear out, and mail. Our Reader Service Department will handle your request promptly

Corrosion Data Chart **262**

Useful 12x9 in. card to hang on plant walls gives corrosion resistance information for several analyses of stainless steel tubing and pipe. Corrodents ranging in severity from fresh water and blood to sulphuric and hydrochloric acids are listed, with recommended alloys for use with each. Reverse side contains data on standard tubing sizes, as well as dimensions, pressures and tolerances for stainless pipe in schedules 5, 10 and 40. The Carpenter Steel Co., Alloy Tube Div.

(Continued on page 152)

A—Deep crack. B—Tamping Smooth-On in. C—Crack completely sealed.

If You've Never Used SMOOTH-ON, *read this:*

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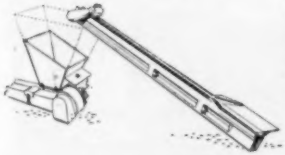

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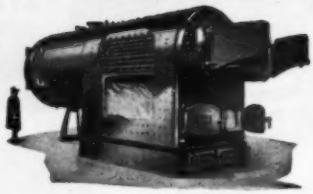

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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

New bulletins and catalogs

(Continued from page 150)

Joint Compound **263**

Folder describes pipe joint compound in stick form. Shows how it is used and points out advantages. Lists such applications as food and refrigeration piping. Lake Chemical Co.

PUMPS

Self-priming Pumps **264**

For pumping applications under suction lift where air or vapor is present in the liquid, Ingersoll-Rand recommends its self-priming pumps. Available as complete motor driven units or mounted to be driven by motor, engine, turbine, etc. Bulletin 7240IR4E1 gives all the details. Lists features, gives selection chart and provides dimensions. Cross section photographs illustrate principle of operation. Sizes ¼ to 25 hp; gpm to 800; heads to 180 ft. Ingersoll-Rand Co.

Controlled Volume Pumps **265**

Bulletin 151, 24 pages, should be of interest to those concerned with pumping controlled volume of liquid, in amounts from 3 milliliters per hr to 50 gpm. Gives complete details on controlled volume pumping along with description of reciprocating, positive displacement type unit. Includes data required for selecting units for specific applications. Four pages of color charts show the relative corrosion resistance of materials of construction to over 170 chemicals. Milton Roy Co.

Chemical Service Pump **266**

Four page, two color bulletin WQ213 is devoted to centrifugal pump for process and chemical plants having semi-critical requirements. Available in 1, 1¼, 1½, and 3 in. discharge sizes and heads to 240 ft. Bulletin includes specifications, dimensions and selection chart; also external and sectional views Warren Steam Pump Co., Inc.

REFRACTORIES

Silica Cement **267**

Descriptive information on silica cement for use in laying silica refractories is contained in 4-page bulletin. Includes photographs showing results of comparison tests. Among properties illustrated are comparative effects of heat treatment, refractories, trowelling and settling. Harbison-Walker Refractories Co.

STEAM SPECIALTIES

Preheater **268**

How live steam is used to heat water or other liquids without noise or vibration is explained in 8-page bulletin H104 on silent preheaters. Major applications include hotwells, filter boxes and feedwater heaters. Lists advantages and gives full installation instructions com-

plete with diagrams showing do's and don't's. Cross section drawing presents design & construction features as well as dimensions. Sims Pump Valve Co.

Trap Selector **269**

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety and pressure conditions. Installation recommendations also included, making this selector particularly useful of engineers who have many applications for steam traps. Yarnall-Waring Co.

Steam Specialties **270**

Four types of steam traps, six kinds of controls, strainers, compressed air traps and other steam specialties are illustrated and briefly described in general catalog 2238. Sarco Co., Inc.

TANKS

Tanks **271**

A new development in liquid storage tanks is fully described in 8-page bulletin 51DF. Said to eliminate breathing and filling losses; prevent contamination or dilution of high purity products; exclude air from deaerated products; decrease corrosion inside tank shell and reduce fire hazards to a minimum. Booklet details many of the applications. Also illustrated and described are tank installations resulting from the conversion of existing tankage with a minimum of new materials. Hammond Iron Works.

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Tank Venting **272**

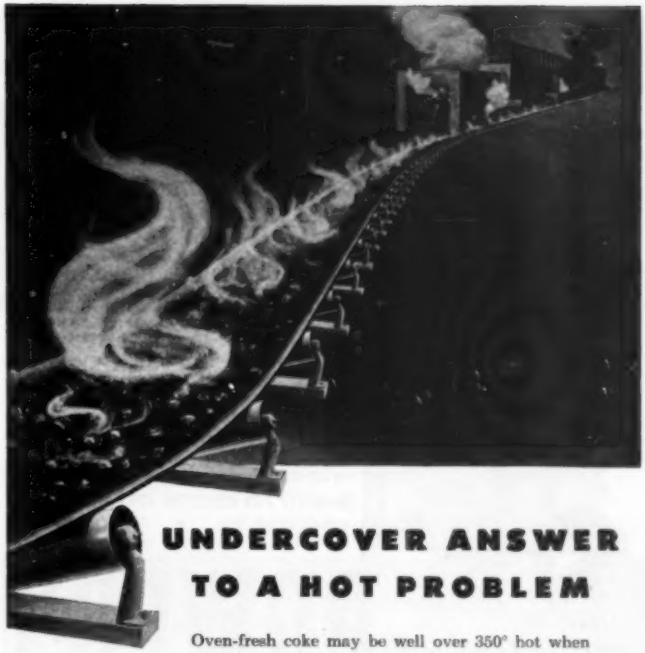
Bulletin CP2001 illustrates and describes tank venting equipment. The 32-page booklet also presents series of tank equipment, gas control and safety devices for the safe handling and conservation of combustibles or toxic liquids and gases. Sectional drawings and photographs illustrate each unit. Sizes and dimensions given in tabular form along with other engineering data. Vapor Recovery Systems Co.

TOOLS

Tool Catalog **273**

Complete line of over 400 tools is illustrated and described in 104-page catalog TR. Lists all types of socket wrench equipment, hand tools and wrenches, punches, chisels, screwdrivers, pliers, tool boxes and other related tools and equipment necessary for industrial servicing operations and main-

(Continued on page 154)



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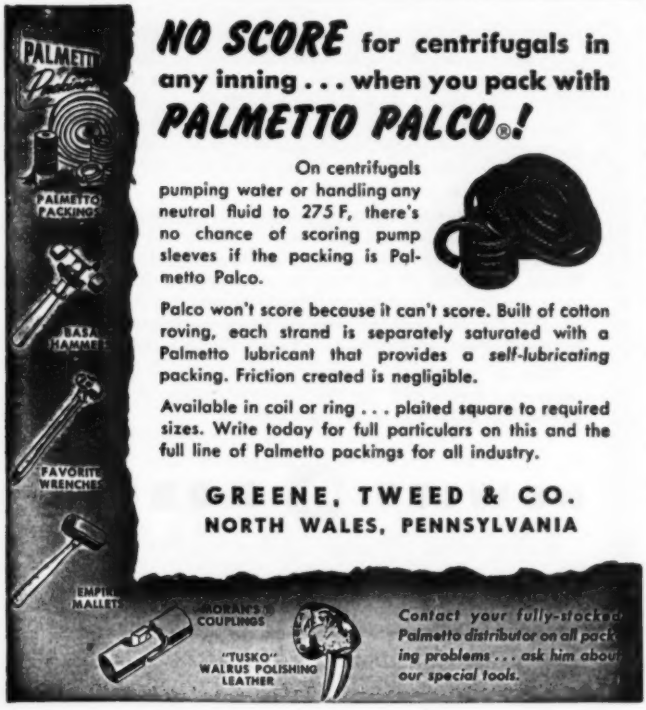
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New bulletins and catalogs

(Continued from page 153)

tenance work. As complete specifications are included, it is easy for engineers to find exactly the tool needed to fit particular jobs. Snap-On Tools Corp.

Hammer-drill **274**

Bulletin 510 on electric hammer and drill completely describes how this tool can drill concrete, masonry, metal and wood; and, cut and chip concrete along with other hammering jobs. Lists hammer tools and accessories for grinding, buffing, wire brushing, right angle drilling etc. Wodack Electric Tool Corp.

Industrial Markers **275**

Markers made of paint molded into convenient stick form, used for marking any type of surface—hot, cold, dry, oily or rusty—are described in illustrated folder. Gives details on eleven types and includes selection chart for choosing the correct type for specific needs. Markal Co.

Soldering Flux **276**

All-purpose soldering flux in stick form is covered in illustrated folder. Explains features of the handy stick and lists industrial applications. Lake Chemical Co.

TRANSFORMERS

Transformers **277**

Dry type auto and double wound power circuit transformers are presented in 8-page bulletin 501-15. Lists transformers having various primary and secondary voltage combinations with double wound transformers available in capacities ranging from 50 to 15,000 va, auto type transformers 100 to 10,000 va inclusive. Contains diagrams, charts and photographs along with typical selection problem. Dimensions and other data included. Jefferson Electric Co.

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Distribution Transformers **278**

Wound type core combined with new insulation applications said to provide smaller unit with greater thermal capacity and better voltage regulation is de-

(Continued on page 156)

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See how Darling cast steel gate valves save you time and money!

YOU know how important low-cost, *easy* maintenance can be. It's one of many Darling Valve features worth shouting about.

For example, all *Darling* parts are precision-made to jigs and templates. Replacement parts slip in quickly and easily.

What's more, Darling valves are designed so that seat rings and all working parts are easily removed and replaced without taking the valve bodies from the line.

These maintenance and repair advantages, plus many other time-and-money-saving features, apply to Darling gate valves of both popular types shown at right. It adds up to low-cost performance at its over-all *best!* Ask for the Darling Cast Steel Valve Bulletin. Get *all* the facts so you can judge for yourself!

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Above: Cutaway showing Darling gate valve of the fully revolving double disc parallel seat type.

Below: Cutaway of Darling slotted wedge gate valve with double guide grooves.

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Latest Developments in Control Valves for Air · Gases Liquids · Semi-Solids

The W. S. Rockwell Valve News describes new developments in Rockwell automatic and manually controlled Butterfly Valves, Slide Valves and valves of special design for use in plant piping and processing equipment for control and shut-off.

It presents interesting ideas in design, construction, method of valve operation and industrial applications to meet the various conditions of physical and chemical nature of the material handled, pressure and temperature.

The Valve News is helpful in sizing up your current and future valve needs.

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This book gives a comprehensive discussion of the theory of corrosion, along with practical descriptions of all known methods of combating corrosion. The book deals mainly with the ferrous metals, and in this edition, includes new sections on Biological Influence and Cathodic Protection. Rewriting is extensive throughout, to make the treatment representative of many advances in practical corrosion preventives.

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CORROSION

Causes and Prevention

By FRANK N. SPELLER
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664 pages. 177 illustrations. 60 tables. $10.00

The first part of the book describes the generally accepted Electro-chemical Theory of Corrosion, and a system of classification of corrosion phenomena and corrosion testing. The second part applies principles to corrosion prevention under the conditions found in the air, underwater, underground, in closed water systems, steam generators, steam and hot-water heating systems, in the chemical industries, and in other situations. The book explains the mechanism of corrosion and the practical methods of prevention as applied to engineering application. The engineer and architect will find it a valuable help in solving specific corrosion problems.

Covers such topics as:

- applications of electro-chemical principles in explanation of corrosion and pitting of metals
- corrosion-resistance of high-ferrous alloys containing nickel, chromium, and combination of these elements
- effects of carbon dioxide, hydrogen sulfide, acids, alkalies, salts, oxidizing compounds, and other miscellaneous factors
- specifications for corrosion testing
- preparation of metal surfaces for coating
- methods of mitigation

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New bulletins and catalogs

(Continued from page 154)

scribed in 4-page bulletin 61B7641. Lists construction features and includes dimensions for conventional and self-protected types of oil-immersed, self-cooled, single-phase transformers built in accordance with EEI-NEMA standards in ratings to 25 kva. Allis-Chalmers Mfg. Co.

VALVES

Water Hammer **279**

Cause, effect and control of water hammer in piping systems are considered in 8-page bulletin WH951. After describing water hammer in non-technical terms, the brochure indicates its potential damage to piping, instruments and other parts of water systems, and then considers methods of controlling it. Also included are results of tests made to determine what effects check valves have in overcoming water hammer. Findings reported for water hammer are believed equally true of other liquids, according to the booklet. The Williams Gauge Co.

Check Valves **280**

Silent check valves, designed to prevent water hammer, are described and illustrated in 4-page bulletin WH100. Said to not only eliminate noises, but also prevent the pressure surges which can result in damage to piping systems. Booklet includes technical data, cutaway versions of two types of valves and series of installation photographs. Available in all regular pipe line sizes from 1 through 20 in. The Williams Gauge Co.

Safety Relief Valve **281**

Discharge header systems based upon the partial or complete elimination of back-pressure effects on tied-in safety-relief valves are discussed in 34-page manual 51B. Claimed to offer savings on the cost of conventional discharge piping, this manual gives operating test data on complete line of bellows-type safety relief valves, as well as data of general interest to those concerned with closed safety-relief discharge systems. Large part of the manual is devoted to theoretical and operating data. Farris Engineering Corp.

Gage Valve **282**

Forged steel gage valve with a male inlet in ½ in. size is completely covered in bulletin 510. Features are described and applications listed. Includes full dimensions, data. Edward Valves, Inc.

Blow-off Valves **283**

Up-to-date information on blow-off valves for pressures up to 400 lb is given in revised 24-page bulletin B425 (1951). Lists construction features, specifications, styles and dimensions. Numerous diagrams, tables and photographs give complete details. Selector table included. Yarnall-Waring Co.

Power Plant Valves **284**

Handy, quick reference guide to cast and forged steel valves illustrates and

describes only those valves applicable to power plant use. Other valves are listed, but with brief descriptions only. The pictorial content covers blow-off, instrument, non-return, cast steel check, and cast and forged steel globe and angle valves. Lists design and construction features. Edward Valves, Inc.

WATER TREATMENT

Softeners **285**

Bulletin 4530, 16 pages, tells the whole story of hydrogen zeolite cation exchange softeners. Gives advantages for certain applications along with diagrams that show some arrangements possible with the units and accessories. Characteristics and capacities of the zeolite are discussed. Includes on-the-job photographs. Cochrane Corp.

Water Treatment **286**

Full line of water conditioning equipment for boiler feed, process and other industrial needs is presented in 4-page catalog. Contains brief descriptions of softeners, dealkalizers, degasifiers, filters, storage tanks, and other water treating accessories, as well as single, double and four column demineralizers. Typical installation problem is presented and the solution given. Penfield Mfg. Co.

Ion Exchange Material **287**

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various operating conditions. National Aluminate Corp.

Styrene type cation exchanger is covered in 28-page bulletin 58. Contains complete discussion, supplemented with tables and graphs. Physical characteristics, exchange capacity and regeneration technique given. National Aluminate Corp.

Bulletin 59, 6-pages, gives complete information on synthetic gel type zeolite for cation exchange. Technical discussion along with tables and graphs show performance. Characteristics, capacity and regeneration technique are explained. National Aluminate Corp.

WELDING & CUTTING EQUIPMENT

Nickel Welding **288**

Fusion welding of nickel and the high alloys is covered in 44-page technical bulletin T2. Contains more than 30 tables and almost 50 drawings and photographic illustrations. Covers various forms of electric arc welding as well as gas welding. Gives such information as the ASME boiler code, pickling, testing and inspection safety methods and associated topics. The International Nickel Co., Inc.

Welding Equipment **289**

Up-to-date information on complete line of electrode holders, ground clamps, cable connectors, terminal connectors, cable splicers, mechanical and solder type cable lugs, carbon electrode holders, and block and punch for attaching solder type lugs to cables without solder is contained in illustrated 12-page catalog 8. Contains details about care and maintenance of welding equipment. Tweco Products Co.

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Expander, Mandrel and Joint in one compact unit, assures easy entry and withdrawal.

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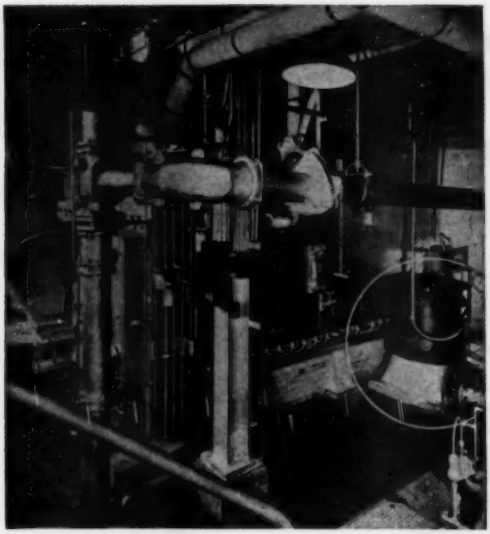

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AIR STRAIGHTENING VANES
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Can be Mounted Vertically or Horizontally
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consistently satisfactory performance Wing Blowers have been delivering for over half-a-century—plus many superior features of Wing design, such as the volume control (Voltrol) vanes, permitting capacity regulation down to 10% of maximum. Write for complete details and latest bulletin

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AXIAL FLOW BLOWERS

Spot news

(Continued from page 109)

the rotor, hydrogen is cooled by conventional water-to-hydrogen heat exchangers.

The heat removing ability of the supercharged design is demonstrated by test data showing that in less than one-fiftieth of a second hydrogen passes through the full length of the rotor passages of a 60,000 kw machine, while at the same time it absorbs enough heat to raise the temperature to 90 F.

In addition to the great savings in copper and steel effected by the new design, several other very important advantages are brought about. Powerhouses of the future will be smaller and less costly, resulting from the shorter rotor and reduced rotor removal space required. Foundations will be simpler and reduced in size. Short circuit currents are substantially reduced, with consequent savings in cost of circuit breakers, reactors and other equipment and with less damage likely to occur in event of short circuit within the newly designed unit.

According to Allis-Chalmers engineers, the change from air to hydrogen cooling first introduced about 16 years ago and now universally used on machines of this type accomplished a 20 to 30 per cent boost in ratings for an equivalent frame size. By comparison, supercharged cooling in one step has raised generator ratings a further 70 per cent without any increase in amount of active material required. Future developments may well increase this gain.

Alkaline Chlorination Solves Cyanide Waste Problem

Several years ago when the National Carbon Company's flashlight plant at St. Albans, Vt., was under construction, proper waste disposal installations were a prime concern. To protect receiving waterways from acid and cyanide contamination from their plating and metal cleaning wastes, complete treatment of such flows was essential. In this case, both acid and cyanide wastes had to be disposed of,

5000 KW DIESEL POWER PLANT FOR ARIZONA RURAL AREA

Five 1440 hp dual-fuel Superior diesels driving Ideal generators are installed in new Trico Electric Cooperative plant near Marana, Ariz. The 5000 kw plant serves rural customers in 16,000 sq mile area south of Tucson. Station capacity will soon be increased another 2500 kw

but the cyanides presented the greater problem. Whereas caustic could be added to neutralize the acids and precipitate out most of the metal ions as oxides or hydroxides, the cyanides had to be destroyed by oxidation. Alkaline chlorination was the method chosen by the engineers for cyanide disposal.

Early investigations in treatment processes were carried on by National Carbon's general engineering department, and by Wallace & Tiernan. In the final treatment layout, it was decided to mix the strong cyanide stream with the main plant waste of 125,000 gpd. The cyanide solution flows intermittently and averages about 1800 gal per month. This stream is piped to a storage tank and metered proportionally to the main flow. The resulting dilute cyanide solution of approximately constant concentration is then treated by alkaline chlorination.

The strong acid wastes are treated with caustic in a separate system. No cyanides are present in this flow and neutralization followed by settling of precipitated metal salts is the only treatment necessary.

Forced Air Systems Cool Cables In Electric Generating Plants

Successful use of forced air systems as an expedient to cool cables in generating plants where capacity has been increased was reported recently by engineers R. W. Burrell, A. J. Falcone and W. J. Roberts from the Consolidated Edison Co. in an address before the American Institute of Electrical Engineers. Con Edison, faced with the problem of modernizing generator plants to increase capacity to keep pace with load growths, had the choice of adding ducts, changing size, type and number of cables, or using metal clad bus on the one hand or of installing forced air cooling to absorb the higher cable losses.

Forced air cooling at relatively low cost was applied to 15 generator units. A number of installations also were made on bus tie-in circuits, station runs of tie feeders and various other circuits where cables were operating above prescribed temperature limits. Another installation was made recently in an underground run in a generating station yard where hot-spot conditions prevailed. As a result, the engineers reported:

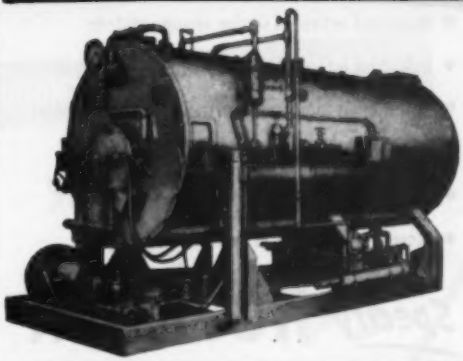
"The adaption of forced air-cooling principles to station cables in ducts is an expedient which, while not generally applied in connection with new construction where adequate current carrying capacity can be obtained with conventional self-cooled systems, often does offer, however, an economical and practical solution to the problem of eliminating rating limitations in existing cable installations where special restrictions were imposed."

Low-Cost Engineering Materials Among New Developments by Carboloy

Coincident with the opening of the Metals Congress and Show in Detroit on October 15, Carboloy Dept. of General Electric Co. announced five new research developments of major potential importance to industry. Included was an entirely new and different type of metal carbide said to have some properties superior to those of conventional metal carbides and to be substantially lower in basic materials cost, while eliminating the need for using two highly strategic materials—tungsten and cobalt. Also announced was preliminary data on developments in bearing materials which may solve many of the problems involved when bearings

(Continued on page 160)

MODERNIZE
with the
AMESTEAM
GENERATOR



● COMPLETE ● COMPACT
● ACCESSIBLE ● EFFICIENT
● AUTOMATIC
10 to 500 h. p.—
15 to 200 lbs.

Here are the facts!

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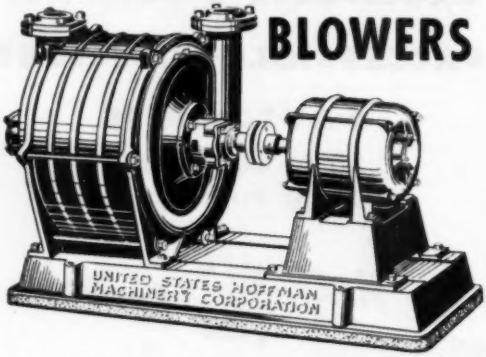
BOX 911 OSWEGO, N. Y.
Builders of Better Boilers since 1848
Manufactured under License in Canada by VOLCANO, Ltd., Montreal, P. Q.

When the Process Demands
CLEAN, DRY AIR
at constant pressure for

- Municipal activated sludge sewage systems
- Industrial activated sludge waste disposal systems
- Agitation of industrial acid neutralization systems
- Oxidation of industrial wastes for disposal
- Removal of cake from continuous filters
- Blow-back cleaning of sediment filter beds

Specify HOFFMAN
MULTISTAGE CENTRIFUGAL
BLOWERS



DELIVER AIR ENTIRELY FREE FROM ANY OIL, MOISTURE OR VAPORS. POWER INPUT VARIES WITH VOLUME HANDLED

Built for heavy-duty, continuous service . . . no internal moving parts, no internal lubrication to contaminate air. The standard for a variety of applications in paper mills, plating works, steel mills, textile mills, canneries, rubber plants, chemical works and auto plants. Models for a wide range of pressures and volume, for air or gas. Write for Free Bulletin A-650.

HOFFMAN ALSO BUILDS HEAVY-DUTY INDUSTRIAL VACUUM CLEANING EQUIPMENT IN STATIONARY AND PORTABLE TYPES. *Write for Bulletins*

AIR APPLIANCE DIVISION U.S. HOFFMAN MACHINERY CORPORATION
108 EAST 12th STREET, NEW YORK 3, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Spot news

(Continued from page 159)

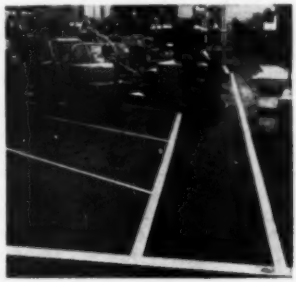
are required to function under high load, high speed, and high temperature conditions.

Additional new developments include materials capable of resisting extremely high temperatures; a new Carboloy product of specific interest to the electrical field; and a new form of carbide which can be "flowed" onto metal surfaces instead of requiring brazing or mechanical attachments.

Once known primarily as the major producer of cemented carbide tools and dies — a position it still retains — the Carboloy organization recently broadened its field with the manufacture and marketing of permanent magnets and metals for radio-active screening.

"Scotch" Tape Marks Off Industrial Plant Areas, Aisles, Truck Routes

Marking truck lane's and safety area's on the floors of industrial plants and warehouses can be done adequately by using one type of "Scotch" brand plastic film tape. It is reported that the tape will outwear other sprayable or brushable stripping materials. According to the Minnesota Mining and Manufacturing Co., the tape can be applied by maintenance men without the loss of employe or trucking time in the taped-off areas.



Tapes for marking off floor areas are obtainable in colors, are easy to apply at low cost, and are resistant to most industrial liquids

Other advantages claimed for the new method are: (1) resistance of the tape to acids, alkalies, water, salt water, alcohol, and hydro-carbons such as gasoline and kerosene; (2) reduced costs due to speed and simplicity of application; (3) ability to alter marked-off areas without leaving traces of the former stripe; (4) extreme ease with which damaged areas can be repaired or replaced; (5) lack of floor ridge, due to tape's thinness (4 mils); and (6) tape's pressure-sensitive adhesive will grip immediately upon contact.

Seven colors are available to help identify specific floor areas such as red for danger areas, canary yellow for safety zones, etc. Other colors include white, orange, blue, green, brown and black.

7000 Steel Warehouse Salesmen In Drive To Collect Steel Scrap

Mobilization of 7000 steel warehouse salesmen to canvass manufacturing executives across the country in an effort to comb industry for steel scrap was announced recently by

(Continued on page 162)

for FUSE ECONOMY...use ECONOMY FUSES

YOU SAVE 3 WAYS!

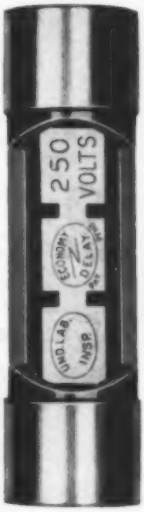
FIRST—with "ECONOMY DE-LAY" Renewable Fuses you save money every time you have a current "blow". Simply remove the blown link and replace it at the cost of only a few cents with a new, "ECONOMY DE-LAY" Renewal Link in the same cartridge.

SECOND—you save because of the short time required to make this replacement—and time is money.

THIRD—you save by reducing "down time" on machines—because an inexpensive carton of Economy Fuse Renewal Links kept on hand 24 hours a day, answers fuse renewal requirements *immediately*.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.



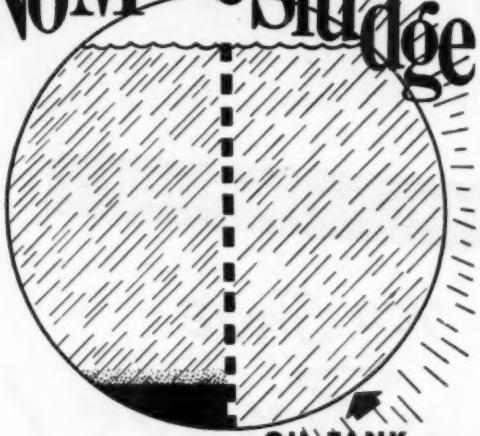
ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

© Reg. U. S. Pat. Office

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

5730

No More Sludge



OIL TANK STAYS CLEAN!

USE HOUGHTON

HOUGHTO-SOLV

FAST-ACTING ADDITIVE!

DISSOLVES EXISTING SLUDGE!

Houghto-Solv makes the sludge in the bottom of your tank burnable. Cuts down waste. Eliminates messy cleaning of tank and system.

PREVENTS SLUDGE DEPOSIT!

Every gallon of Houghto-Solv keeps as much as 4,000 gallons of fuel oil free of sludge formation. No costly sludge problems for Houghto-Solv users!

MORE BTU'S PER FUEL DOLLAR!

You burn sludge along with the fuel oil you buy. You get extra heat. Order a trial drum and start getting all these cost-saving benefits immediately.

HOUGHTO-SOLV
. . . a product of

E F HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

Spot news

(*Continued from page 160*)

Walter S. Doxsey, President, American Steel Warehouse Association. In cooperation with the Steel Industry Scrap Mobilization Program, which is being conducted by the nation's steel producers, the Warehouse Association anticipates that its 7000 salesmen will be able to discover and channel back into the mills and foundries an additional million ton of vital steel scrap during the two months remaining in this year.

Steel warehouses are the normal sources of supply to hundreds of thousands of relatively small manufacturers and small consumers of steel. Every steel customer, regardless of size, will be visited by warehouse representatives and urged to cooperate in the nations's scrap salvage campaign.

Manufacturers will be requested to collect and sell all dormant scrap to reputable scrap dealers and brokers who have immediate outlets for this material.

The steel warehouse program is already under way. Responsibility has been accepted for scrap collections in 64 of the 334 districts set up by the Steel Industry Scrap Mobilization Committee which cover the entire country. Warehouse executives have been appointed to direct the collections in each of these 64 districts. The remaining 270 districts will be under the supervision of the Steel Industry. The American Steel Warehouse Assoiation embraces 700 outlets which supply steel to over 500,000 customers.

For Accurate PRESSURE REGULATION and TROUBLE-FREE SERVICE

Class AWG Reducing Valve

Accurate Regulation of pressures on machine tool, air and liquid lines is no problem with the Leslie AW Reducing Valve.

Trouble Free Service is assured from this fully self-contained, small, compact unit giving the following features:

- ★ CAST VIRGIN BRONZE BODY AND PARTS
- ★ OIL RESISTANT DIAPHRAGM AND VALVE INSERT
- ★ CORROSION RESISTANT SPRING
- ★ INTERCHANGEABLE REPLACEMENT PARTS
- ★ TOTALLY ENCLOSED—NO STUFFING BOXES
- ★ QUIET OPERATION
- ★ INLET PRESSURE RANGE 10-200 psi at 150° F.
- ★ REDUCED PRESSURE RANGE 5-75 psi

Class AWG is furnished with pressure gage at slight extra charge.

Dimensions and capacity data are included on Dwg 1223, available on request.

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LESLIE CO.
263 Grant Ave., Lyndhurst, New Jersey

PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS
FLOATLESS LEVEL CONTROLS • PUMP GOVERNORS
TEMPERATURE REGULATORS • SELF CLEANING STRAINERS
AIR HORNS • STEAM WHISTLES

CLASSIFIED ADVERTISING

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2 DIESEL ENGINES—Both are Fairbanks-Morse Company diesel engines equipped with alternators and exciters for generating electric current. One is 2 cylinder style VA-100 HP - 257 RPM with Type D alternator - 75 KVA. The other is one cylinder same style but 50 HP - 40 KVA. Fuel systems of both engines have been modernized. Both are 230 volt, 3 phase, 60 cycles. Further details and prices on application.

MAURER-NEUER CORPORATION
Arkansas City, Kans.

FOR SALE

1 - 400 KW or 1 - 300 KW Westinghouse A. C. to D. C. Synchronous Rotary Converter purchased new 1941. Either unit complete with stepdown transformer, 13,200 volt, 60 cycle, 3 phase Primary, 188 volt, 6 phase Secondary. Circuit breaker, disconnect switch, starting panel and 125 - 250 volt, D. C. panel complete with circuit breaker, main switches, volt and ammeter.

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Saxe Erection Units position and secure structural parts for welding. The adjustable K3A clip permits adjustment of structural members for plumbing and erection. Use of these units eliminates all hole punching and produces the most economical, safe, and quickly erected structural frame.

Write for **"Structural Welding Practice"** manual, containing full engineering design information.

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AVAILABLE REPRINTS

SPECIAL REPRINT
of the report on
INDUSTRIAL WASTE TREATMENT

To fill requests, received for additional copies of the special report on "Industrial Waste Treatment" June 1951 issue, it has been necessary to re-order reprints. These reprints are being offered to our readers ***free of charge in quantities of 1 to 5.*** We find it necessary, however, to quote a slight charge for printing costs for quantity requests. Charges are: 6 to 25 copies—25¢ each; 26 to 50 copies—20¢ each; more than 50 copies—15¢ each. Order directly from Reader Service Dept., INDUSTRY AND POWER, 420 Main St., St. Joseph, Mich.

We also have following reprints available, free of charge:

"Boiler Houses Are Not Necessary Evils," February, 1950

"Caribou Diesel Plant Built In A Hurry", February, 1950

"Correct Plans Consider Future Expansion Too", December, 1950

"Diesels In A Hydroelectric System", June, 1950

"Falls City Production Not Hampered During Recent DC To AC Changeover", July, 1950

"Filters—What They Are, How And Why They Are Applied", February, 1951

"Grievances Can Be Avoided", April, 1950

"Harbor Plant Pioneers In Pneumatic Build-Up Refractory", December, 1950

"How To Select The Correct Steam Trap", January, 1950

"How To Select Corrugated Expansion Joints", June, 1950

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"Trigonometric Calculations—I and II", April, 1951

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PREFABRICATED STEEL BUILDING

20' wide by 10' clear span. Any length in multiple of 10'. Dismantled. Can be refabricated to double width or height. Suitable as is for dry storage. Interior nailable Stran-Steel Components available for approximately 4000 square feet floor space.

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St. Joseph, Michigan

BOILERS
10 to 5000 H.P.
Diesel, Steam Turbine, Engine
GENERATORS
Heavy Power Equipment
Industrial—Chemical Process Equipment
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Manufacturers and Distributors of Plumbing, Heating, Industrial and Refrigeration Supplies and Equipment

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FOILED AGAIN!

Those three little villains — Dust, Dirt, and Grit — are *foiled every time* they match their wits against a CLEMENTS-CADILLAC blower-suction cleaner. It blasts them out of every nook and cranny of your machinery and equipment—quickly, easily, and economically.

Eligible under C.M.P. regulations.

SAVE TIME · MONEY PREVENT DAMAGE TO MACHINERY WITH THE . . .

Made in 5 models with attachments for every cleaning job.

CLEMENTS CADILLAC PORTABLE COMBINATION BLOWER-SUCTION CLEANER

CLEMENTS MFG. CO.
6638 S. NARRAGANSETT AVE., CHICAGO 38, ILL.

ASK YOUR MILL SUPPLY DEALER OR WRITE US FOR DATA

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MORE POWER TO MATERIALS-HANDLING
WITH QUALITY *SILENT HOIST* EQUIPMENT

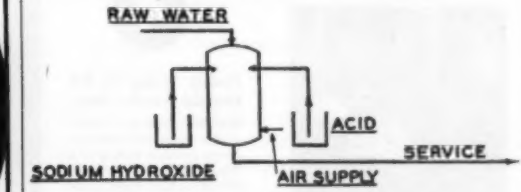
KRANE KAR Swing-Boom Mobile Crane **speeds and cuts the cost** of handling all loads in plant construction, maintenance, repairs; loads and unloads freight cars, trucks, and trailers; stacks loads for storage. 1½, 2½, 5 and 10 ton cap. Ask for Bull. #79. **"SILENT HOIST" CAR PULLERS** move and spot freight cars, warp barges, open hopper doors, etc.

Use SH power-driven Capstans, Gypsies, and single and double drum Winches for rigging, skip hoists, cable ways, maintenance, construction, etc. Ask for illustrated Bulletin #64A. *Thousands of* ***KRANE KARs*** *and* ***SH Car Pullers*** *are serving industries throughout the world.*

SILENT HOIST & CRANE CO.

656 63rd STREET, BROOKLYN 20, N. Y.

PURER THAN RAIN!



PURER than rain. Purer even than MULTIPLE DISTILLED water! This is the product of H & T's ion exchange Demineralizing Units. Impurities are removed by actual ion exchange — a process that insures the purest water. Surprising enough, the cost of a custom-built unit for your special needs is probably well under the figure for any other method of obtaining really pure water.

Bulletin DM tells how this process works in detail. Write for it.

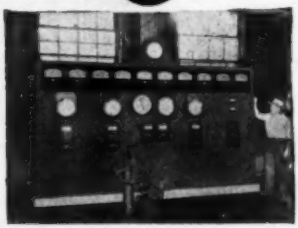
H&T SERVICE

HUNGERFORD & TERRY, INC.

CLAYTON 1, N. J.

5 ways to use HAYS

1



Pressure and Flow Measurement in Gas Producer Plant. In this automatically controlled gas producing plant Hays FOT Indicators show gas header pressure, stack pressure, air pressure, and air flow. The FOT is a popular pressure-flow instrument in the process industries.

2

Resistance Measurement in Air Conditioning Systems. The Hays air filter gage is a money-saver when used to indicate the amount of resistance through filters in air circulating systems. When equipped with open or closed switches it flashes or sounds an alarm when resistance becomes excessive.

3

Commercial Boiler Testing Portable easily handled Hays "8" gages are widely used for checking draft in the combustion chambers of small automatically fired boilers to assure maximum efficiency. The scales are easily read—large black figures on a light background. Gages are compact, rugged.

4

Product Testing by Differential Pressure Measurement. Here the simplicity of the Hays FOT indicator makes possible testing of a complicated product by unskilled workers. Hays gages were selected because of their accuracy and because they could be supplied with large, easily read scales.

5

Continuous Draft Indication in Boiler Furnaces. Banks of Hays "V" gages are a familiar sight in thousands of boiler rooms. They provide an accurate "picture" of furnace draft conditions at any given moment and thus warn the operator of soot deposits, slag accumulations, too thin a fire, burned out baffling, etc.

HAYS has the most complete line of low pressure gages on the market.

• 4 diaphragm units available for both pressure and differential • diaphragms of colon leather or of synthetic impregnated material highly resistant to corrosive atmospheres, moisture and oxidation • 4 case sizes • as many as 12 pointers in one case • ranges from a minimum of .2" water to a maximum of 120" water • for indicating, recording, or controlling draft pressure, differential or flow • wall, lug, or flush mounting—also portable models • interior or exterior illumination • square root extractors available.

What's your draft or pressure problem?

Hays engineers are anxious to help you solve your low pressure measurement and gas or air flow problems. They have applied Hays gages to situations ranging from the determination of fuel oil level in marine vessels to the measurement of the density of mud in oil drilling operations. Send a description of your problem to Clarence Miller, The Hays Corporation, Michigan City, Indiana. You'll receive Hays' recommendations plus Bulletin 49-667 describing the complete line of low pressure instruments.

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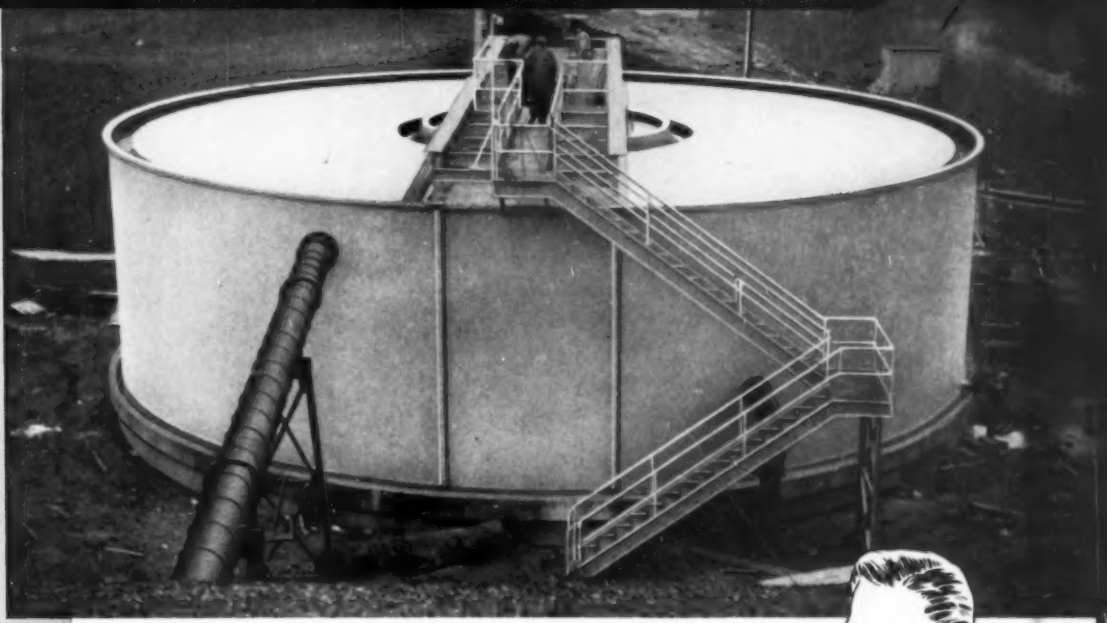
A *Good* waste-treatment system...



costs *far less* than you think!

HERE'S HOW ONE MAN LEARNED THIS FACT:

A paper manufacturer, faced with the problem of waste treatment in his plant, guessed that a good system would cost him a six-figure sum. To avoid paying so high a price, he sunk a considerable amount into a home-made system—which simply did not do the job. And so he called in consulting engineers.

After making a complete survey of the mill, analyzing samples of its waste, and thoroughly studying the problem, the engineers made their recommendations. They were accepted by the surprised manufacturer, and the system was built.

The waste-treatment plant cost *even less* than the supposedly-cheap makeshift equipment that had failed, and it provided an effluent completely acceptable for re-use in the mill.

It also produced some benefits the manufacturer never expected:

- **A large amount of raw stock was recovered**
- **Stream pollution was eliminated**
- **There was an important reduction in heat losses**

The manufacturer estimates the new system will have paid for itself within three years!

Maybe *you* have been putting off the question of water, sewage, or industrial waste treatment for your plant or community because you think the cost prohibitive. Don't guess; you will probably be wrong! *Call in consultants specializing in this field.*

FREE BOOKLET

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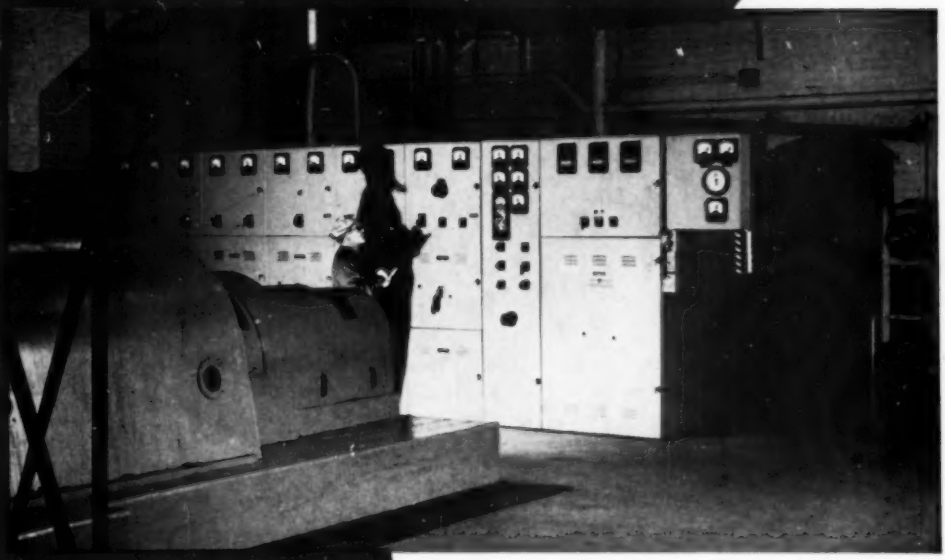

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